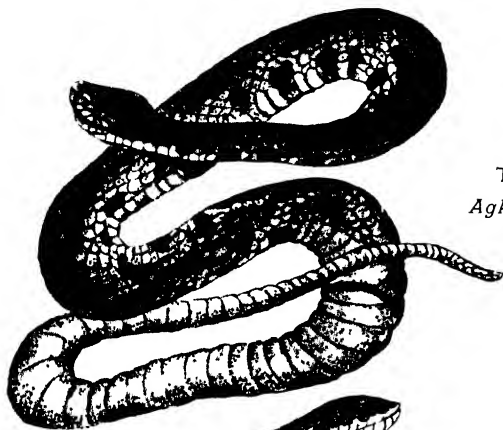
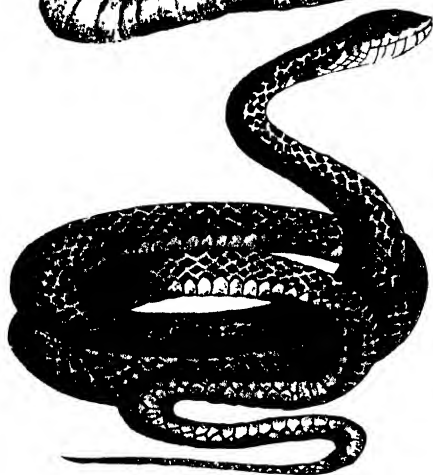


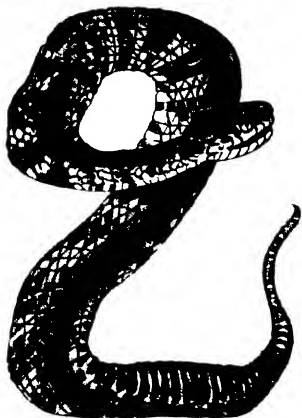
205540



The Copperhead.
Agkistrodon mokasen.



The Black Snake.
Coluber constrictor
constrictor



The Moccasin
Agkistrodon piscivorus

Snake Life Simply Told

BY

J. MOREWOOD DOWSETT

Author of

<i>"On the Spoor of the Elephant,"</i>	<i>"The Spanish Bull Fight,"</i>
<i>"Big Game and Big Life,"</i>	<i>"The Spanish Bull Ring,"</i>
<i>"How Animals Live,"</i>	<i>"Scanderbeg, the Warrior King of Albania," etc.</i>

SECOND EDITION

LONDON

JOHN BALE, SONS & DANIELSSON, LTD

83-91. GREAT TITCHFIELD STREET. W.1.

Made and printed in Great Britain.

CONTENTS.

	PAGE
LIST OF PLATES AND TEXT FIGURES ...	iv
FOREWORD	v
GENERAL INFORMATION ABOUT SNAKES ...	1
HISTORY	20
ANATOMY	22
VERTEBRAL COLUMN	28
CLASSIFICATION	33
BRITISH SNAKES	34
EUROPEAN SNAKES	40
BURROWING SNAKES	42
CONSTRUCTORS	43
NON-POISONOUS SNAKES	48
SLIGHTLY POISONOUS BACK-FANGED SNAKES	50
VIPERIDÆ	50
POISONOUS FRONT-FANGED SNAKES	54
SEA SNAKES	56
GEOGRAPHICAL DISTRIBUTION	58
HABITS, LANGUAGE	59
NORTH AMERICAN SNAKES	77
CANADIAN SNAKES	103
SNAKE POISON	103

LIST OF PLATES.

The Copperhead, the Black Snake, and the Water Moccasin	...	<i>Coloured frontispiece</i>
A terrifying experience in the kitchen		<i>facing page vii</i>
“Tastes differ”	<i>facing page 1</i>
A python, 16½ feet long	...	<i>facing page 14</i>

LIST OF TEXT FIGURES.

	PAGE
Fig. 1. Teeth of poisonous snakes ...	24
Fig. 2. Upper surface of skull of <i>Tropidonotus natrix</i> (Grass Snake)	25
Fig. 3. Head of <i>Crotalus horridus</i> (the Rattle-snake)	25
Fig. 4. Skull of Rattle-snake. Ordin- ary position, fangs folded back	26
Fig. 5. Skull of Rattle-snake. Fangs erected in striking position	26
Fig. 6. Rattle of Rattle-snake ...	53
Fig. 7. The Cobra	55

FOREWORD.

THERE are many erroneous ideas concerning Snakes. If the conversation happens to turn upon the question of Snakes, almost any "Snake tale" is believed because of the general want of knowledge upon the subject. I hope this little book will help to enlighten my readers and dispel some of the ignorance existing to-day in relation to Snakes.

The majority of people think when they meet a Snake that there is only one of two courses open to them : either to kill it at once, or to flee from it, and if the latter, generally "with their heart in their mouth."

Snakes are very hard to find, as they like seclusion, but if you are fortunate enough to find them, and try if possible to conceal yourself and do not frighten them away, you will be fascinated by their ways.

But if you carry fear in your heart you will not be interested.

But why carry fear?

How many people are terrified of a poor defenceless little mouse?

If you pick up the delicate little creature and give it a squeeze it is dead.

They never by any chance attack or bite you, and are shy and nervous and always seek cover.

And yet such fear is caused by some at the sight of a mouse, that women have fainted, and others have had a shock, as if some wild beast were about to charge them.

Snakes are also timid until they get your confidence, and in nearly every case will try and get away from you.

This does not apply to some you may have wounded, or to others which may follow you if you have taken their mate (dead or alive) along with you.

Snakes play the game of bluff like other animals, for they belong to the Animal Kingdom.

They will sit upright on their tails and hiss, and rapidly work their long, slender, bifid tongue as if they were spitting out deadly poison by the yard.

As the tongue is vibrated, the nervous on-looker thinks that every time it is darted forward it is throwing out a deadly sting, and if they feel they are not already caught, and that a painful and speedy death has been averted, they will soon put a respectable distance between the Snake and themselves, their next act being to relate their adventure, and how they managed to escape! When the Snake sees that the intruder has gone, it will quietly continue its hunt for food.

This bluff is inherent in the Snake, quite independently of the schooling it has had in this art of defence.



A TERRIFYING INTERLUDE IN THE KITCHEN A WILD BLAST AT LARGE

There are Snakes which bite dangerously, because they think they are being attacked when you unconsciously tread upon them.

For this reason I always wear puttees when hunting in Africa.

I have watched Snakes for hours.

To run from Snakes which are beautiful and interesting to study is, to my mind, a great waste of opportunity.

It reminds me of a planter I once met in Africa, whom I invited to come along with me to hunt a herd of elephants, for which I had been searching for about three weeks before I tracked them down to within a few miles of his shamba.

When we came up with the herd, after all my fruitless journies, much labour and expense, he said, "Let us get away before they stampede!"

When you have the good fortune to find a Snake, you should use your opportunity of studying its ways.

Of course, with dangerous Snakes you want to keep out of reach, and see that you have not the mate on the other side of you, and do not act temerarily.

This book is written in a simple way as a help to those who wish to know something about Snakes, and I have had the assistance of Mr. W. E. SWINTON, B.Sc., F.Z.S., for the more technical part.

At a well-known girls' boarding-school

where I had four daughters, one of the girls had a Grass Snake as a pet, and I was pleased, for the sake of my daughters and the whole school, that the head-mistress so wisely allowed the Snake to be kept. It was loved by many, and appreciated the fondling of the girls as much as they appreciated their opportunity of doing so.

I have recently been in communication with the "girl" who owned the Snake in question more than twenty years ago, to see if I could obtain a photograph for reproduction here, but unfortunately she has not one.

On the eve of going to Press with this book I saw in the *Daily Sketch* of September 7, 1928, the photograph reproduced entitled "Tastes Differ."

It certainly is a very appropriate title of a little fellow visiting the Zoological Gardens, London, and handling a large Snake for the first time in his life.

The gentleness and grace of the Snake won the confidence of the boy.

And how many different tastes would also be changed to one of affection for Snakes if they knew and understood more about them.



‘TASTES DIFFER.’

This is a reproduction from the *Daily Sketch* of September 7, 1928. It is a very good illustration of what I have tried to convey to the public through this little book about the docility and affection of the harmless snakes.

SNAKE LIFE SIMPLY TOLD.

MENTION of the word "snake" to the average individual provokes the mental picture of a long, thin, cylindrical body, wriggling rapidly along the ground, with death in the form of virulent poison in its frequently protruded tongue. Its appearance and the characters with which legend has invested it make the snake an unwelcome object, producing fear and disgust in those who see it. But the definition of the first sentence is almost wholly insufficient and incorrect; the fear referred to in the second sentence uncalled for, since many snakes are actually beautiful both in the appearance and "feel" of their skin, and most are quite harmless to man. Indeed, many of them make charming and sometimes affectionate pets. The large and long worm-like body is not peculiar to the snakes, as several other reptilia (e g., *Anguis*, the "blind" or "slow" "worm") and amphibia are legless and snake-like in body. In fact, the distinction of legless amphibia and reptiles from one another and the snakes is a practical examination test well known to every student of elementary zoology. By no means all snakes are poisonous, and the rapidly protruded tongue is quite harmless and unconnected with the poison fangs. The only true

definition of the snakes as a group rests on several anatomical features which I shall mention later in dealing with the skeleton and anatomy.

The snakes themselves are a highly specialized group of reptiles, and constitute the suborder Ophidia, which again is subdivided into families, genera and species. The total number of species of living snakes is something about two thousand, while some fifty or sixty species have been found fossil. Their geographical distribution, as we shall see, is very wide, while their habits are extremely diverse. There are burrowing snakes, flying snakes, snakes in the rivers and the seas, as well as purely terrestrial and arboreal forms. It is consequently no easy task to do justice to the group within the limits of space here imposed, or to avoid a sketchiness which must necessarily obscure the detail of a most interesting and important group of living creatures.

The order of the Serpent is known as Ophidia.

The more common classification would be Reptile, but under the class Reptilia would also be lizards, crocodiles, turtles and tortoises.

The study of snakes is called "Ophiology."

There are nine families in the Ophidian order :

(1) Viperidæ. (2) Colubridæ. (3) Typhlopidæ. (4) Boidæ. (5) Glauconiidæ. (6) Uro-

peltidæ. (7) Amblycephalidæ. (8) Xenopeltidæ. (9) Ilysiidæ.

Snakes are classified, like all other things, and placed into different divisions: there are families and subfamilies.

I have often wondered whether the various colourings of birds bear any relationship to the colours, or markings, of their reptile-ancestors before their evolution.

When a boy of eight years of age I killed my first snake. This was at Willesden (at that time green fields), only about five miles from the West End of London. The snake was the Ringed or Grass Snake, and within a year of my first snake-hunting I killed one measuring, I believe, more than 4 ft.

If I had known then what I know to-day, I should have made pets of those snakes.

Every snake can swim, and nature has placed the nostrils of sea snakes upon the top of the snout and also given it additional lung power, the lung practically extending throughout its whole body.

A snake can lie under water for an hour or two without moving. Land snakes are not helpless in the water, or even in the sea. When on the surface of water they will inflate their lung and make themselves buoyant, and when they dive they expel the air.

This year, when cruising in a motor-boat to the south of Spain, I took aboard two cases of oranges at Burriana to bring back to England.

A snake was discovered in one case, and after playing with it for a time I threw it overboard where I was anchored, about one and a half miles from shore.

The snake first dived deeply, but finding the depth too great he came to the surface, and tried for some time to climb aboard. Finding this impossible he set out for land, occasionally rising on his tail to look ahead and around and I watched him with my glasses for some time—still swimming strongly.

He was a land snake (a smooth snake), and so being useful I wanted him to reach the shore.

Sea snakes are helpless on land, and have no use in their eyes; they live on fish and other marine creatures, and are all poisonous.

Poisonous land snakes have hollow or grooved fangs, but not so those which are harmless. The grooves or canals running longitudinally through the fangs, and through which the poison passes to the object bitten.

It is astonishing how long a time snakes can live without food; some say two, some say three years, and some more.

Nearly all snakes have cannibalistic tastes, and they swallow their food whole without using their teeth for masticating purposes.

The eyes of a snake have a transparent film over them for their protection.

The snake uses its tongue for feeling, and the forked tongue is not its sting.

Snakes regularly cast the whole of their skin, even to the eye scales, and which is turned completely inside out.

Sunshine and warmth are life to snakes, who are not migratory, but during the winter hibernate without food or water in secluded places until the spring.

The mouth of a snake is like india-rubber, and the bones of the lower jaw are capable of being pushed aside, and the throat and mouth will stretch to an almost unbelievable extent when the appetite is whetted by some prey which has been secured, and the gastric juices can digest bones, skin, feathers, or even horn. The jaw-bones, which are in two parts, and also the bones of the skull are attached loosely, and the whole is capable of expansion like india-rubber.

The formation of the jaw is the reason why a snake is able to stretch its mouth wide enough for the purpose of swallowing its prey. It has elastic ligaments attached in front to the two parts of the lower jaw, and this permits the separation of the two halves of the lower jaw, and the upper jaw is movable in most snakes, and the tongue falls into a sheath in the mouth, giving a clear passage for the food to pass through.

Snakes have not the wisdom ascribed to them. They belong to the Animal Kingdom.

Immediately after birth snakes are unheeded by their mothers and they must look after themselves.

New Zealand is the only country with a temperate climate that is free from snakes. In my book, "Big Game and Big Life," I relate a Maori legend told me forty-five years ago by old Maoris who were once cannibals, that the Moa bird—the biggest ever known—lived principally upon snakes and exterminated them, but so far no fossils of snakes have been found in New Zealand.

I endorse the statements made that there are no snakes in New Zealand, and that no traces have been found of their existence there. But I do not agree with the very definite statements made that New Zealand has never had snakes.

The snake may have been extinct before the advent of the Maori.

Snakes have evolved from creatures with legs of the lizard type.

Snakes cannot travel over a perfectly smooth surface. The locomotion of the snake is the action of the edges of the ribs upon the shields of the abdomen which grip the ground or tree, The tail is also largely used for propelling the body, which can be curved or twisted in many ways, as there are about 300 vertebræ in the backbone, each having a pair of loosely attached ribs capable of moving backwards and forwards with complete ease. The ribs of one side of its body are moved forward when the snake crawls, and then the edges of the scales grip the ground, and the ribs on the

other side are then brought parallel with the other set, and this draws up the hinder part of the body and propels the upper part.

Snakes die hard although they only possess one lung, and the heart, after being cut out of the body, will beat for nearly half an hour, and if the head only were removed from the body the heart may beat for twenty-four hours, and the body would coil and wriggle for several hours.

The venom of a snake becomes more virulent, and the glands accumulate more virus, as the snake becomes more hostile when hunted; this is nature arming for the fray.

Fear acts upon the organs of the body in the same way that does hostility. I would commend the reader to what I say in "The Spanish Bull-Ring" upon this very important subject, as it may be of great practical value if carefully studied and followed.¹

Snake-bites act differently, according to the species, and some are much more rapid in their action than others.

Snakes have been known to die through the venom of other snakes, when bitten by them.

When snakes are kept in captivity they lose the greater part of their venom, but I do not suggest keeping poisonous snakes as pets as there are so many of the harmless variety.

¹ "The Spanish Bull Ring." Illustrated, 3s. 6d. Published by Messrs. John Bale, Sons and Danielsson, Ltd., 83-91, Great Titchfield Street, W.1.

The Mammoth, Mastodon, Giant Sloth, Diprotodon, Irish Deer, Woolly Rhinoceros and various other animals, which are known only through the fossil remains found and classified by scientists, will be repeated later when the present reptiles will be extinct, as also will be the larger fauna, unless the latter become domesticated.

Snakes, some of which were venomous, were living in the Cretaceous and Early Tertiary periods.

The distance below the earth's surface of the Cretaceous Strata of rocks is about 2,500 ft., and the period of time which has elapsed since these rocks consisted of mud as the beds of lakes, rivers or oceans, is estimated at millions of years.

The growth in the number of species of snakes since the few fossils were found in the Cretaceous Strata of rocks has been considerable, as there are some two thousand different kinds of snakes existing in the world to-day, and which are found principally in tropical and semitropical parts of the world.

Snakes do not have either movable or fixed eyelids, but they have a transparent scale, which is firmly attached, fixed over their eyes, and they have no exterior ear apparatus, although they hear fairly well considering their ear organs are beneath the skin.

Snakes find their prey by hearing, sight, smell and touch, and these senses also provide

them with the means of protection to escape from danger.

The snake's hiss is caused by the inhalations of a large quantity of air, which is then forcibly expelled through the nostrils, and the Puff Adder has the loudest hiss in South Africa.

The activity of the vibrating tongue when molested, together with the hiss, are for the purpose of frightening the enemy and protecting the snake.

Animals will become alarmed at the hiss or sight of a snake, and this appears to be one of nature's protective measures of a reciprocal character.

The snake, on the one hand, would be trodden upon and either killed or badly damaged and, on the other hand, the animal would be bitten and die or suffer seriously.

The tongue is a most sensitive feeler and is forked; usually black in colour and without sting, and during the time the skin is being shed the scales on the eyes become opaque, and the snake feels its way with its sensitive tongue, as the power of sight has temporarily gone.

The old skin is first shed at the lips, and the snake forces its head against branches or crawls through such things as will help to tear off the skin in the same way that the elk, caribou or moose treats his antlers when in the velvet, as mentioned in "Big Game and Big Life."

The old skin is cast off intact, even to the scales over the eyes, and is turned inside out in the process. Oviparous snakes are those which lay eggs, but some give birth to their young; but even in the latter case the young incubate in the body inside soft transparent eggs, or bags, through which the young push their way out with their nose or a shell-tooth. The eggs, though soft, are strong, and are laid in the sun, or where there is sufficient heat to hatch them out.

The age at which snakes begin to breed is four years, and the period of incubation is from three months, according to species.

The male snake is provided with two sex organs which are contained in cavities on either side of the base of the tail, and the female has also two vaginal cavities, so that upon whichever side one may be lying to the other copulation could take place.

The male organ when protruded will turn inside out, and a flow of blood into the organ causes the erection for copulation to take place.

Snakes play their part in protecting the jungle, morass, swamp and decomposed vegetation, where they can live and prevent the too rapid growth of the smaller reptiles and rodents, which breed at such a rapid rate that they would otherwise become a plague.

They swallow millions of frogs, rats, mice and insects yearly, and will penetrate into houses in search of mice and rats. It is well

to realize that by this means snakes play not only a useful part in the preservation of Nature's balance, but do very useful service for man.

But, on the other hand, snakes are also quick-breeding if we consider numbers, for they produce anything between 10 and 100 eggs a year.

Nature again provides many small carnivorous animals and birds of prey to feed upon them, and especially upon their young, in which the parents also assist with the latter, as many snakes have cannibalistic tastes.

The spiky body of the hedgehog and the hair of the mongoose protect these two animals from the bite of the snake, from which, however, they would be immune, and birds will protect themselves by the violent use of their wings, with which they will confuse the snake, and then catch it by the neck in its powerful beak and dislocate the vertebræ.

Snakes are cold-blooded, the circulation being very sluggish and temperature low, and they live for hours without any air.

Many non-venomous snakes will kill their prey by constriction, and this is done very swiftly, and the constrictor muscles are so powerful that a large African Python can squash one of the smaller antelopes into pulp in a few minutes.

If a snake is using its constrictor muscles, do not attempt to liberate the victim by pulling

at the centre of the snake, but take hold of the tip of the tail and unwind it. Strike the tail where the spinal cord is only thinly covered with bone, and you will soon disable or kill it. If you hold a snake by the tail it cannot turn upwards, and if held at arm's length it will do no harm, although it can wriggle from side to side. Boas have seized a man and wound themselves round his body, arms and neck to throw him and actually to swallow him—an awful death for a human being.

Flying serpents are found in Arabia.

Poisonous snakes shed their poison-fangs only—not their other teeth. Nature provides other fangs for their defence. The poison is a transparent fluid of a yellowish colour, and of much the same consistency as human saliva. The effect of the poison of a Cobra being effective second-hand is told by FRANCIS T. BUCKLAND, M.A., who speaks of its virulence. A rat which was killed by the bite of a Cobra was skinned by a surgeon, and in scraping away the fat from the skin with his nails to find the punctured holes made by the fangs, he took a little of the poison into a crack in his flesh under the nail. He had just cleaned his nails with a knife (a foolish way to clean them), and into this crack he took the poison from which he had the following symptoms in a few minutes. He had not walked a hundred yards before he suddenly felt as if somebody had come behind

him and struck him a severe blow on the head and neck, and at the same time he experienced a most acute pain and sense of oppression at the chest, as though a hot iron had been run in and a hundredweight put on the top of it. He knew instantly from what he had read that he was poisoned, and told his friend that if he fell to give him brandy and eau de luce, and to keep him going, and on no account to let him lie down. He then forgot everything for several minutes, and rolled about as if very faint and weak. His face was of a greenish-yellow colour, and after walking or staggering along for some minutes he gradually recovered and reached a chemist's, who was without eau de luce, but he saw a bottle labelled "Spirit Ammon. Co.," or hartshorn, and he took a large quantity with a little water, and although it burnt his mouth and lips he instantly felt relief from the pain in his chest and head. After a second draught from the hartshorn bottle he left feeling very stupid and confused. He then went to the house of a friend and drank four large wine glasses of brandy without feeling any intoxication. The pain under the nail was now acute, and also up the arm, and he realized how the poison had entered his system. He sucked the wound, and was soon free from the pain. The poison had been circulated in the body of the rat, from which he had imbibed it second-hand.

In swallowing its prey the snake usually commences with the head, and it is strange to relate that when mongoose, pig, hedgehog and other snake-eaters devour snakes they usually start with the snake's head.

Snakes swallow their food whole, without mastication, the process sometimes occupying an hour or so, and a succession of gulps, with the body muscles moving forward, and the recurved teeth pulling the object, completes the operation.

The prey is then forced lower down into the stomach where the digestion takes place, and which may take a week or two in the case of a big meal.

When a snake has very considerably distended its jaws in swallowing its large prey it is in a rather helpless state and loses its power of locomotion.

If it be attacked when in this state its first thought is for self-preservation, and it immediately disgorges its prey.

Python can swallow an antelope whole, including its horns, which would in time be digested with its wonderful digestive juices, unless the points of the horns protruded through the skin, and which would in time drop off, and the holes made by the horns in the snake's skin would quickly heal.

They will lie under water for long periods with only their nostrils showing on the surface, and lie in wait for antelope, which they



TALLIS SHOES ARE STILL BEING TALL FROM THE SINCE THIS IS IT FASHION

seize when drinking, and quickly constrict and elongate and swallow.

They are not poisonous, their teeth being quite solid, but they are recurved and can bite with considerable power.

They have been known to live two and a half years without food.

The flesh of the Python is tender and palatable and is eaten by many.

There are in South Africa about thirty snakes having solid teeth (*Aglypha*).

They seek their food principally in the daytime, but this is regulated by the hours during which their prey come out to feed, although instead of finding food they provide food for the snake, and so it is with nature all the time, one living upon another.

Apart from being cannibals, even to their own species and their young, they also prey upon lizards, toads, frogs, insects and their larvæ, and birds and their eggs, and the larger snakes also add to their menu monkeys, hares, rats, the smaller antelope and larger birds.

Tree snakes prefer food found upon trees, and the water snake prefers frogs and fish, and in all cases they look for living prey.

Coloration of its surroundings is very helpful to snakes in Africa, and which is assisted by the law of Nature for concealment from its prey.

Fresh-water snakes live near to, but not in,

the water, and live upon such fish as are found in the rivers or marshes, together with frogs and tadpoles.

Sea snakes are very venomous, and their bite will immediately prove fatal to fish. They usually have brilliant colours.

Some snakes hibernate during the winter, and some only for a few days at a time, according to the temperature, and they do not like wet or cold weather.

Most of the African snakes climb, but not the Burrowing Snake or the House Snake.

The Bird Snake and Mamba make their homes principally in trees, and their movements are very swift and silent.

They show great cunning by keeping their bodies quite rigid like the boughs of the tree, and are of the same colour, so that birds will sometimes be quite unaware of their presence and fall an easy victim.

The Puff Adder will sometimes climb trees and lie along the branches, and Python also climb trees and often prove too quick in their movements for monkeys, which fall victims to them.

The average length of a Puff Adder is about 24 in. The colour of the back is a dark purple-brown, and a pale brown or yellowish belly, but they vary considerably.

They are very venomous, and fortunately have a loud hiss, which warning, if recognized, affords protection to the unwary who

may be walking unconsciously over them, as I have almost done myself.

The poison fangs are not grooved, but hollow, and are powerful and long and can be moved backwards and forwards, and if these and the duplicate sets are removed, together with the anterior maxillary bone, it would be rendered harmless.

After striking its victim it will leave it to die, at the same time watching it carefully.

The female develops her eggs inside her body, and after the young have pushed their way out of the transparent sac they crawl away and shift for themselves, quite independent of their mother; the period of incubation is believed to be seven months.

They are about six inches when born, and are quite venomous and ready to fight at once, and can live for about three months after birth without food.

They coil up and try to avoid observation by lying still. With a direct injection of the venom into a vein, death would take place within two minutes, and dogs have been known to die within three minutes.

The glands of a Puff Adder are about the size of a kidney-bean, and the constriction of the muscles which compresses the glands violently forces out the venom.

It bunches up its body and withdraws its head when about to strike, and it can stand almost upright to the full length of its body,

and has about one hundred and fifty pairs of ribs.

It throws its head back before striking, then sideways or forward, and it strikes so quickly that the movement of its head is hardly seen when the fangs are at work, and they have several pairs of duplicate fangs.

If an active pair were extracted another pair would take their place in a week or two, as the new fangs are ready for action a day or two after the old ones were extracted.

Of all the South African snakes the Mamba is the one most feared, and they are very plentiful where there is timber. There are two colours of this species, black and green.

If you attack a Mamba you must kill him outright, as if you only wound him he will pursue you until he gets his fangs into you, and these are in front and easily used.

Vipers are distributed practically over the whole world. The poison glands are secreted on either side of the head, below and at the back of the orbit, and when in the act of biting the contracting muscles discharge the poison.

In the viper the fangs and bones related to them are movable, and are controlled by various muscles which automatically come forward when contracted for biting.

The poison is a thick liquid of a rather clear or yellow colour.

The Mamba, Puff Adder and Cobras, the latter of the larger species, are the most

venomous snakes found in South Africa. The Boomslang is venomous, although some writers say it is not.

The teeth of snakes are curved inwards, and the non-venomous possess two rows of small teeth in the upper jaw, and one in the lower, and are all solid and without grooves.

There are a number of snakes with two rows of upper teeth which have one or two in the outer row longer than the others, and which are grooved, and such snakes are venomous.

Night Adders belong to the Viper family, and are so named as they generally seek their food at night. They are poisonous, the glands lying on each side of the neck and communicating through the usual duct with the poison; they lay eggs and coil round them to hatch them.

The Horned Adder is also of the Viper family, and is about 12 to 18 in. long.

The Berg Adder is found in the mountains, but not exclusively so, and it is very venomous.

The smallest snake (*Glauconia dissimilis*) is only 4 in. in length.

We have therefore the Proteroglypha—or Venomous Snakes—with grooved or hollow fangs, along which the poison passes.

The Opisthoglypha, which have fangs in one or more of the back teeth in the upper jaw which have grooves and possess poison glands

The Aglypha, which have solid teeth and are not venomous.

HISTORY.

From a geological point of view the snakes are not an old group. The terrestrial life and habits of most members of the group are not, of course, conducive to their preservation as fossils. Such fossils as have been found and described are exceedingly fragmentary, and it may be frankly conceded that their affinities are, to say the least, doubtful. This is also due to the small number which has been found. The oldest forms known are *Dinilysia*, a member of the family Boidæ, from the Upper Cretaceous of Patagonia, and *Coniophis*, referred to the Viperidæ, found in the uppermost Cretaceous deposits of North America. The suggestion has, however, been made that the Cretaceous snakes so far described belong to another and extinct group of reptiles (Mosasauria). The majority of fossil snakes come from the Tertiary formations of Europe, America and India; those from the Late Tertiary (Pliocene and Pleistocene) are generally indistinguishable from living forms. One species of which mention should be made is *Gigantophis garstini*, Andrews, from the Eocene of the Fayum, Egypt. A portion of the jaw and some vertebræ preserved in the British Museum show that this snake attained the enormous length of 50 or 60 ft.

It is considered by many zoologists that the snakes are probably the latest of the major

groups of Reptilia to be evolved. Of the group, probably the Viperidæ are the youngest family.

The Ophidia are a group which possess for diagnostic purposes few positive characters: the negative features, the absentees from the anatomical congregation, are the more useful in classification. Few indeed of the characters in their make-up are not shared by other groups, and it is the combination of positives and negatives to which we must turn for our definition.

The following diagnosis, however, contains the most important groups of characters which are peculiar to the suborder:

Elongated, legless reptiles varying in length from an inch to thirty or more feet and having the right and left halves of the lower jaw joined by a ligament only. In the skull there are no temporal arches, as jugals, quadratojugals, epipterygoids, lachrymals, or post-orbitals and occasionally squamosals (or tabulars) are absent. There is complete bony closure of the brain case. Owing to the absence of some of these bones there is great mobility of the jaw. The premaxillæ are often toothless, the maxillæ rarely so. Teeth usually occur on the pterygoids and palatines. There is no parietal foramen. No trace of pectoral girdle or front limbs. A series of procœlous vertebræ, sometimes as many as four hundred, having in addition to the zygapophyses,

zygantra and zygosphenes. No sternum or sternal ribs. No urinary bladder.

Such a diagnosis as formulated above gives an idea of the complexity of anatomical characters peculiar to the snakes. The individual characters are not unknown elsewhere; indeed most of them occur in other reptiles, particularly in the families of lizards, but the combination is unique to the snakes.

ANATOMY.

In size and in anatomical characters great variety exists among the species and even individuals of the suborder. The following account can therefore only be taken as a very general one for the whole group. The more important variations from the general plan will be indicated in the accounts of the families which follow. It should be understood that it is quite impossible to deal with the anatomy without using a number of scientific terms and without requiring a certain amount of knowledge of comparative anatomy, but we shall keep the account as simple and popular as possible. One's first impression on seeing and handling the skull of a snake concerns the looseness and fragility of the bones and the slenderness of their joints or articulations. This is due to the amount of reduction which has taken place during the evolutionary course of the snakes. The cranium has, of course, strong affinities with

that of the lizards, but differs essentially in the absence of the bones forming what one knows as the "temporal arcades," and in the complete ossification, bony union, of the front part of the brain case. Starting from the front of the skull and going backwards, we notice the reduction of the premaxillæ, which are small and often toothless, and the two form in this instance an unpaired bone. The maxillæ are long and narrow, though they are often reduced in size, and generally bear teeth, although in the Vipers (Viperidæ) only one functional tooth is present. The number and arrangement of the teeth vary enormously in the various families and genera. The parietals are always fused and there is no parietal foramen. Often this unpaired bone forms a sharp crest and overlaps the occipitals. The quadrate is loosely suspended from the squamosal (= according to some authorities the supratemporal or tabular), and this in turn is loosely attached to the lateral parietal region of the skull, placed horizontally and elongated considerably backwards, with the result that the vertically-placed quadrate lies in a plane behind the skull. The pterygoids are usually loosely attached to the inner side of the distal ends of the quadrates and often touch the mandibles. The right and left pterygoids and palatines are widely separated from each other. Both pterygoids and palatines usually bear long teeth. The condition of this part of the

skull is greatly altered in the burrowing snakes (Typhlopidae and Leptotyphlopidae), on account of the reduction of pterygoid, maxillaries and ectopterygoids. The ectopterygoid as a rule in snakes is strongly developed and very rarely is absent. It joints the maxillary and palato-ptyergoid arches.

As has been indicated, the skull of snakes is especially different from that of lizards by the bony closure of the brain cavity in front. This is due in part to descending plates of the parietal and frontal. The brain cavity is gene-



FIG. 1.—Teeth of poisonous snakes. A, opisthoglyphous type; B, solenoglyphous type. pg, poison groove; pd, poison duct; pc, pulp cavity.

rally very long. The exoccipital and opisthotic bones are fused. All the cranial bones are rather ivory-like in appearance and dense, and united by comparatively smooth sutures. Bones which are constantly absent are the jugals, epipterygoids, post-orbitals and lachrymals. The squamosals and ectopterygoids are also absent in some forms (see figs. 2, 4 and 5).

The mandible is of primitive structure. According to Williston, the coronoid is absent or fused, the so-called coronoid being the pre-articular. It is certainly absent in several

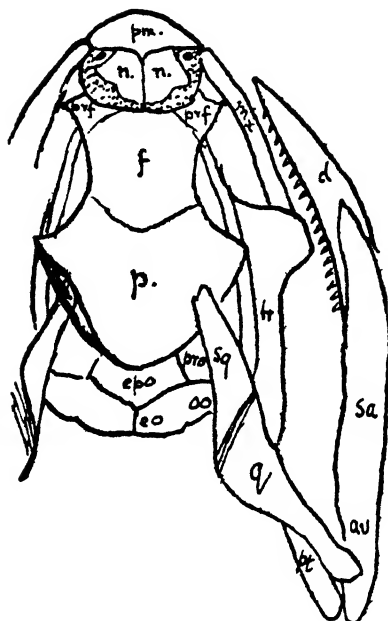


FIG. 2.—Upper surface of skull of *Tropidonotus natrix* (grass snake). After Parker. ar, articular; d, dentary; eo, exoccipital; epo, epiotic; f, frontal; mæ, maxilla; n, nasal; oo, opisthotic; p, parietal; pm, premaxilla; pro, prootic; pt, pterygoid; q, quadrate; sa, surangular so, supra-occipital; sq, squamosal; tr, transversum.

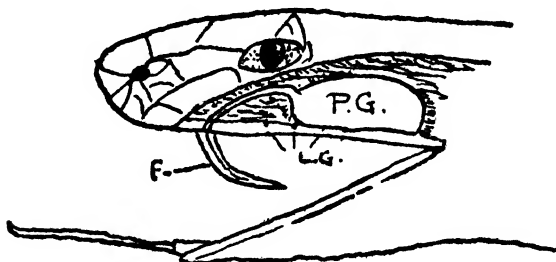


FIG. 3.—Head of *Crotalus horridus* (the rattlesnake). pg, poison gland; lg, ordinary labial glands; f, fang.

families, is large in the Boidæ, and much reduced in the Ilysiidæ. The long splenial enters the symphysis.

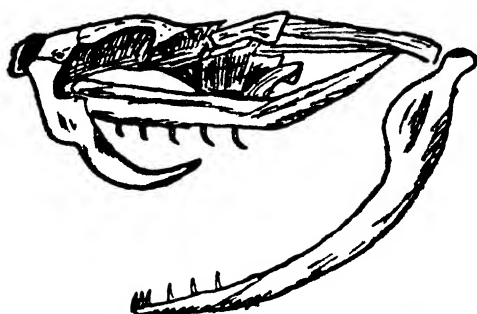


FIG. 4.—Skull of Rattle-snake. Ordinary position, fangs folded back.

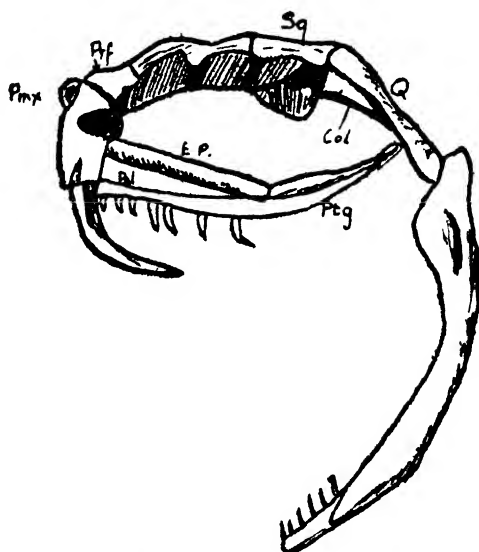


FIG. 5.—Skull of Rattle-snake. Fangs erected in striking position.

The teeth of the snakes are remarkable for the variety of type and arrangement which occur. As a rule they occur on the maxillæ,

palatines, pterygoids and dentary bones and, rarely, on the premaxillæ. In the Uropeltidæ they are wanting on the palatines, while in three genera (*Oligodon*, *Dasypeltis* and *Atractaspis*) palatal teeth are restricted to the palatines. The teeth are always sharp, recurved and acrodont (i.e., fused to the margin of the bone). Primitively they were lodged in sockets, but in the more specialized types they have become lodged in grooves and firmly fused to the edge of the tooth-bearing bone. There is a perpetual succession of teeth. The poisonous snakes have peculiarly modified teeth connected at the base with the poison glands. Either they are grooved or contain a canal or tube. These have slit-like openings connected with the gland, and when the snake strikes the venom is squeezed through the canal or groove into the wound. Grooved teeth, fixed rigidly to the maxillæ, are present also in some non-poisonous snakes. The position of the groove is made use of in classification. Those snakes in which the anterior teeth are grooved (e.g., the Cobra) are classed as Proteroglypha, those in which posterior teeth are grooved, Opisthoglypha, while the term Solenoglypha is applied to those snakes (e.g., Viperidæ) in which the groove has become converted into a canal through the growth of the tooth surface. (See fig. 1.) The special modifications of the Viperine teeth will be dealt with under that family. Apart from

these poison fangs, the varying position of the teeth and their characters are largely used for classification.

VERTEBRAL COLUMN.

The vertebral column consists of a very large number of vertebræ, sometimes three to four hundred. They are what is known as pro-cœlous vertebræ, that is, concave in front and convex behind, the articulations between two being thus by a ball-and-socket joint. In addition to the ordinary bony processes (anterior and posterior zygapophyses) they are strengthened by two-sets of articulations dorsally to the zygapophyses on the neural arches. These are the zygosphenes, carried at the anterior end of the vertebral body or centrum with their articular facets directed downwards, and the zygantra posteriorly placed with upwardly facing articular surfaces. The effect of these is to strengthen considerably the backbone and to lessen vertical movement, while side movements are unrestricted. It may be well to point out again that the snake accomplishes its locomotion by a side-to-side wriggle and not an up-and-down one, as frequently imagined. Although these zygantra and zygosphenes are characteristic of the snakes, they also occur to a certain extent in the lizards and were present in the extinct reptiles known as Mosasaurs. The neural arches are fused firmly to the vertebral

centra. The number of vertebræ and the number of ventral and transverse scales of the skin correspond. True hæmapophyses (descending processes on the under surface of the vertebræ) do not occur, but simple hypapophyses are general in the anterior part of the body and may continue into the later vertebræ. These serve for the more effective attachment of the muscles. The transverse processes are short and stout. All the vertebræ except the first two or three carry ribs. These are attached only by a single head and are very movable in fore-and-aft direction. Their ventral ends are implanted in the connective tissue of the sides of the ventral transverse scales, the edges of which, being sharp and imbricating, are principally responsible for the movement of the snake. The snake thus moves through the agency of its ribs, literally walking on the ends of them. For this reason the snakes are often called "vertebrate centipedes." The ribs are long, curved, and often hollow. In the tail region their place is taken by lengthened transverse processes.

There are no traces of shoulder girdle, front limbs, sternum or sternal ribs. As has already been said, some forms preserve traces of the hind-limb apparatus. Occasionally here traces of the ilia, ischia and pubis with parts of the vestigial femora can be seen, although externally only a claw-like spur may be visible on each side of the vent.

The skin is covered by horny scales and is quite free from any ossifications (osteoderms). The name "shield" is applied to enlarged scales. The keel of the scale is the thickened, ridge-like cutaneous part. This horny epidermis covers the whole of the creature, even its eyes, and is shed several times a year. The shedding starts at the tip of the snout and is carried backwards. The new skin is grown through the activity of the ectoderm, and during the process the snake is, of course, blind, since its eye covering is affected. The eyes possess no lids in the ordinary sense. These are present in the embryo, but they unite to form an extra protection which is covered by a transparent horny scale, through part of which the snake sees. It is obvious that tears cannot be shed in the usual way, but are drained through the lachrymo-nasal ducts into the nasal cavities.

The snake's hearing apparatus is also peculiar. The external ear is not visible, the internal middle-ear is reduced, and the tympanum, tympanic cavity and Eustachian tubes are missing altogether. There is a long columnellar rod furnished with a fibrous or cartilaginous pad at its outer end which is in contact with the quadrate, an arrangement which must, especially during the act of swallowing, cause a great noise in the inner ear. Snakes hear quite well as a rule.

Probably as useful as sight or hearing in the

pursuit of prey is the sense of smell, and the nose of snakes seems well developed.

The reduction in the hyoid apparatus already referred to has one important result. During the laborious business of literally getting outside its prey, the snake can advance its glottis between the halves of the mandible and so prevent itself choking. The tongue is a slender and very protractile organ with a bifid structure. It is always moist and is well supplied with sensory corpuscles. It acts entirely as a sensory organ, like the whiskers of a cat, and is in no way a deadly sting, as people like to think. The process of eating the prey is a very laborious one requiring a great amount of physical effort, so much indeed that the snake often has to rest during the process. The victim is not covered with saliva or slime first, but during the swallowing process there is a good deal of salivation which may have given rise to this supposition. The snake takes the head of its prey first and advances first one half of the mandible on it, then the other. This process continues, the snake actually getting itself outside its victim by this mandibular movement. The snake almost bursts itself over a fairly large victim; its skin becomes distended, the scales are pushed well apart, and the veins stand out prominently. The process of digestion is comparatively long, during which the snake is obviously dormant.

Correlated with the long cylindrical body

and the absence of fore-limbs and functional hind-limbs, there are many modifications in the internal anatomical arrangements. The visceral capacity is reduced, and as a result the lungs are unequal. The right is usually the larger, while the left is often very small and may even be absent. The right lung is a thin-walled, hollow bag, the posterior third of which is devoid of respiratory cells and is simply an air reservoir. The heart is three-chambered and quite lizard-like. The differences in the vascular systems of snake and lizard are entirely due to the absence in the former of limbs and the greater use of the vertebræ in snakes. Then in snakes the subclavian arteries are absent in the right arch, and the left pulmonary artery (owing to the reduction of the left lung) is very slightly developed. On the other hand, all the vertebral arteries and veins are well developed. In the stomach gastroliths are often found. These stones, which also occur in crocodiles and fowls, probably help in the digestive process.

Snakes have no urinary bladder, but otherwise their cloacal anatomy is similar to that of lizards. The copulatory organs are concealed beneath the skin in recesses of the posterior lateral corners of the cloacal chamber. On each side of the latter, in both sexes, there is a rounded gland which secretes an offensive and strongly-scented substance.

While the vipers and most thoroughly aquatic snakes produce their young alive, most snakes lay eggs. The eggs, which have a soft parchment-like, usually non-calcareous shell, are often produced in quite considerable numbers.

CLASSIFICATION.

The problem of classification of the large number of species in the group is naturally one which has exercised many minds. Probably the first serious attempt, based on dental characters, was made in 1852, since when at least three other classifications have been put forward. The most satisfactory are obviously those in which anatomical characters prevail; notably the negative anatomical characters, i.e., the absence of particular structures in the skull and limb girdles, &c., are used. Such a classification, excellent as it is for university and museum purposes, is of little value for ordinary practical purposes, and any scheme likely to appeal to the casual collector must be based on obvious and external features. For this purpose Gadow¹ has created a table of external characters which appears to work very well, and is sufficient for the determination of at least the family. It will be obvious again, however, that either of these classifications, though suitable for the textbook, is out of

¹ H. Gadow, "Amphibia and Reptiles," The Cambridge Natural History, vol. viii, Macmillan and Co., London, 1923.

place in the popular account, and for our present descriptive purpose a more simple classification in accordance with the habits of snakes is required. We shall accordingly treat the group under the following rough headings :—

- (1) Burrowing snakes.
- (2) Constrictors.
- (3) Non-poisonous snakes.
- (4) Slightly poisonous back-fanged snakes.
- (5) Vipers.
- (6) Poisonous front-fanged snakes.
- (7) Sea snakes.

BRITISH SNAKES.

There are three serpents in Great Britain, as follows :—

Vipera berus : The Viper or Adder.

Coronella austriaca : The Smooth Snake.

Tropidonotus natrix : The Ring or Grass Snake.

The *Vipera berus* can be found practically over the whole of Europe, with the exception of the cold northern portion.

The British *Vipera berus* or Adder averages from 20 to 25 in., and has been found more than 28 in., and exceeds the largest Continental Adder. The tail would be one-eighth of the total length.

The head is of a flat character, and upon it are two dark bands with a V-shape mark which converge at the snout; these markings,

however, show much variety, and in some cases can hardly be described as a V.

Behind these markings the Adder is of a brown and dark brown, almost black, colour, and continuing along the back has a zigzag black line which also varies, and the belly is more varied still and has many shades from grey to a slate-coloured blue, but the colours vary according to the sexes.

Adders are found in the ferns and bracken, on grassy banks, stony places, and wherever there is most warmth to be found in their locality.

The Adder lives upon small birds, mice, newts, glow-worms and other lizards, moles, water-voles, insects, ant-eggs, birds' eggs and young rats, and the digestion is rapid, although meals may be between rather long periods.

The tail of the female is more prominently defined, but is not so thick as the male, which latter includes the sexual organs.

Adders with scales on the throat of a black colour, or edged with black, will be found to be males, and the scales of the females will be found to be yellow or reddish.

But there are a great variety of colours in the British Adders.

It has neither external eyelids, tear ducts, nor lips. The jaw is very mobile, and the jaw-bones will move so freely that the mouth and throat can be distended to a great extent, as if it were made of the best quality elastic.

The usual recurved teeth are found in the lower jaw, and in the upper the fangs, which have a very fine point and curve backwards, measure about one-third of an inch.

They lie in a groove, horizontally, until required for striking, when they are brought into vertical position for action.

At the base of each fang there is a gland which secretes the venom, which is emitted through the sharp point of the fang.

The gland has a duct leading to the canal through the fang, and this canal is closed, and not only in a groove-like form which many poisonous snakes have.

The venom will pass down this canal from the duct in a second by using the muscles of the lower jaw in biting.

In the fang-sheath there are always developed fangs ready when required to replace those in present use.

The tongue is bifid, and is used for feeding and feeling purposes, and is in no way harmful.

The fangs are, or the poison which passes through them is, firstly, the means which the Adder uses for the purpose of defence, and secondly, the means by which the Adder obtains its victims, not all of which are killed by the venom, as many are swallowed alive.

Many victims fall every year to the bite of an Adder, and include cattle, dogs and sheep, but the cause of death is unknown.

It is not easy to discover their bite, as the

fangs only leave a mark which would be made by a pin if deeply inserted into the flesh.

The Adder hibernates in the winter, and in April the pairing begins, and about four months later the young are born.

The Ring or Grass Snake, *Tropidonotus natrix*, is probably the best known member of the group.

In colour this snake has a bright yellow band round its neck, with dark spots on its back and sides, and the body is olive-green or a greyish-green, the sides being of a lighter and more yellowish shade, and the belly is a variegated black and grey. Two or three colour varieties occur in different parts of Europe, over practically the whole of which the species is common. It is, however, absent in Scotland, Iceland, and northern Scandinavia. It is also found in Asia Minor, West and Central Asia, and Algeria.

Grass Snakes are harmless, and although, when cornered, they will hiss and strike, they do not bite. In time they would become very tame and even affectionate and able to distinguish their friends. They will eat from your hand. Grass Snakes and their allies require a lot to drink. They generally take water, but occasionally will accept milk. It is seldom realized that Grass Snakes make good pets. They will live quietly in one's house and they are useful in keeping down mice. They are excellent and even affectionate pets for any young naturalist.

The average length would be from 33 to 38 in., but have been found up to 5 ft. 8 in., and they are the most numerous of the species found in Great Britain, and are also found practically throughout Europe.

The tail is about one-quarter the length of the snake. In England the Grass Snakes appear in spring and hibernate in the ground in autumn.

It is generally found near water, and is a good swimmer, and its food is also found in or near the water and marshy ground. Despite the abilities of the parents in water the young are easily drowned.

Its diet consists of frogs, toads, newts, fish, mice, birds' eggs, and water voles. When in the water they catch fish with their bellies, and eating is usually done on the shore.

This snake is oviparous, and will lay any number of eggs from, say, twenty to thirty, about the size of a pigeon's egg, late in the spring. They are stuck together by a glutinous fluid. Each egg is really separate and would produce an offspring, and which would be about eight weeks after the eggs have been dropped, when they have already reached some development since they were deposited. The young, when they appear towards the end of summer, are fed on worms and insects, and when a few weeks old on young frogs.

The same negative points referred to in

the Adder apply to the Ring Snake, which is neither venomous nor vicious, and makes a nice pet, and even its bite would be quite harmless. Pairing usually takes place in May or June, and the eggs, usually about two or three dozen, are laid six or eight weeks later in manure heaps or in any rich vegetable soil.

The teeth of both jaws are recurved and point to the throat, and there are two rows in both jaws, and the tongue is very active, long and forked.

The jaw-bones are capable of distension, as in the case of the Adder.

A habit peculiar to the Ring Snake is the emission of a very unpleasant smell when it meets an enemy, and this offensive liquid is contained in two glands just inside the anus. They eject the contents of the cloaca and anal glands, which have a most disgusting smell.

It hibernates and casts its slough irregularly, but more frequently than other snakes.

The Smooth Snake (*Coronella austriaca*).

This snake is rather rare in Great Britain, but it is more plentiful on the Continent of Europe.

The male will average about 23 in., and the female about 24 in.

In colour it is of a brownish-yellow, brown, or reddish-brown.

It feeds upon lizards, mice, &c.

It emits a nasty odour, and assumes an attitude of ferocity by standing at full length

erect upon its tail and hissing and darting out its tongue very actively, but it is quite harmless.

It is viviparous, bringing forth its young about half a score at a time.

It hibernates, and casts its slough in April after hibernation, but also two or three times later in the year.

All the British snakes hibernate, and this also applies in a general way to all snakes which live in cold or cool climates, and which is done to escape the penalty of the cold, from which snakes are very susceptible.

In addition to the three British serpents already mentioned, there are also of the Reptilian order the Viviparous Lizard, Sand Lizard, Wall Lizard, Green Lizard and Glow-worm.

EUROPEAN SNAKES.

There are four families of the Serpent order in Europe :—

Viperidæ. Typhlopidæ. Boidæ. Colubridæ.

There are twenty-eight species :—

Vipera berus. *Vipera ursinii*. *Vipera aspis*.
Vipera lebetina. *Vipera renardi*. *Vipera latastii*.
Vipera ammodytes. *Ancistrodon halys*. *Typhlops vermicularis*. *Eryx jaculus*.
Tropidonotus natrix. *Tropidonotus tessellatus*.
Tropidonotus viperinus. *Zamenis gemonensis*.
Zamenis dahlia. *Zamenis hippocrepis*. *Coluber*

quatuorlineatus. *Coluber dione*. *Coluber longissimus*. *Coluber leopardinus*. *Coluber scalaris*. *Coronella austriaca*. *Coronella girondica*. *Contia modesta*. *Calopeltis monspessulana*. *Macropotodon cucullatus*. *Tarbophis fallax*. *Tarbophis iberus*.

These are the European species, according to G. A. Boulanger, whose opinion would be accepted by herpetologists sans peur et sans reproche.

The largest snake in Europe is the *Coluber quatuorlineatus*, which has been found 8 ft. in length.

The smallest snake in Europe is the *Typhlops vermicularis*, and which does not exceed 14 in.

The shortest and stoutest European snakes are the Vipers, especially *Vipera ursinii*, and the longest and slenderest are the *Coluber* and *Zamenis*.

In recording the colour and markings of snakes, whether the latter consist of bars, spots or stripes, it should be observed that these vary very much in the same species, and also that you will often find that even the two sides of the body vary and are not alike in their markings.

Pairing takes place in the spring, and also again in the late summer or early autumn with European snakes.

Snakes grow slowly and have a long life, but their duration is not known in the natural wild state.

BURROWING SNAKES.

Four families contribute to this group: the Typhlopidae, Leptotyphlopidae, Uropeltidae, and part of the Ilysiidae.

The first of these is a family entirely of burrowing snakes, which have the body covered with cycloid scales and the teeth restricted to the small, transversely-placed maxillary bones. They are blind and have the skull much modified on account of their burrowing habits. They have remains of the pelvis, one vestigial bone on each side of the vent. They appear to be the remnants of an archaic stock which has suffered degeneration through its burrowing and insectivorous habits. The family is widely distributed in all tropical and subtropical countries, even being found on Christmas Island. New Zealand is, however, free from them.

The Leptotyphlopidae are closely similar to the previous family, but differ in some skull bones and the arrangement of the teeth. They are interesting in that they have the most complete pelvic remains of any snakes. Iliac, pubic, ischial and vestiges of the femora are still to be seen. S.-W. Asia, Africa, and the warmer parts of America are the localities in which the family is to be found. Both the Typhlopidae and Leptotyphlopidae are fond of white ants' nests. The smooth, scaly skin of the snake is a protection from the ants, which in turn form a constant and handy food supply.

The burrowing snakes of India and Ceylon belong to the Uropeltidæ. They have a short and rigid cylindrical body and a short tail ending in a large peculiar shield which is no doubt useful in burrowing. The scales are smooth and round. Mandibular and maxillary teeth are present and quite normal. These snakes show no vestiges of a pelvic girdle or hind-limbs. Some of the members of the family are very beautiful in colour. They are all viviparous and frequent damp localities, particularly in hilly and woody districts.

The Ilysiidæ are similar in general characters to these other burrowing snakes, and lead a partly burrowing life in South America, Malay Islands, Ceylon and Indo-China. They are viviparous and live on worms, insects and young or small Typhlopidae. They are not all blind. One species, *Ilysia cytale*, found in South America, is a very beautiful snake, and being harmless is reported to be worn by native ladies as a cooling, if somewhat fidgety, necklace.

CONSTRUCTORS.

The constricting snakes belong to the family Boidæ. They are numerous and vary much in size, habit and distribution. Some are quite small and worm-like, while others attain a length of over 30 ft., with a girth of about 9 in., and weigh some hundred pounds.

The family is noteworthy in that members retain traces of the pelvic girdle and limbs, though externally the latter are seen only as spur-like projections on each side of the cloacal opening. Usually they exhibit some of the bones normal to a limb. The tail is comparatively short and is of material assistance in aiding the animal to climb trees in the wooded districts which these snakes prefer. Some species are also partly water-living and others prefer a more or less sandy place. The Python is a familiar animal to most people, and possibly has had its powers exaggerated more than any other snake. There certainly exist strange notions as to the size of animal a Python can kill and eat. Undoubtedly a large animal such as one of the great snakes of this group has great powers and can crush an animal as large as a cow, but a moment's reflection will suffice to show that it is physically impossible for the prey to be swallowed. The snakes of this group prefer to kill their own food, and have a preference for warm-blooded animals. The snake coils itself round its victim and ultimately crushes the unfortunate creature to an almost unrecognizable mass. The smaller quadrupeds, such as sheep, calves, and various kinds of small game are the usual prey, but tigers, cows, and even human beings are among the victims. The limit of size which the snake can eat can be taken to be about that of a nearly full-grown sheep. The food

is crushed and formed into a sort of sausage before swallowing.

The Boidæ lay eggs. Occasionally the female curls herself round them. This, however, has less to do with an incubating process than the desire to preserve them.

The Boidæ are divided into two subfamilies : (1) Pythoninæ, and (2) Boinæ.

The first of these may be distinguished by the presence of supra-orbital bones on the skull, and teeth (few and small in number) on the premaxillæ. The scales on the under side of the tail are generally in two rows. The principal genus is *Python*, which is well known to almost everyone as a common feature of Zoological Gardens' snake exhibits. *Python* has a well-marked head quite distinct from the neck and covered with small scales. The body scales are also small and smooth, those under the tail being in two rows. The pupil of the eye is vertical. The range is over all the palæotropical region (tropical and subtropical of Old World) and Australasia, with the exception of Madagascar and New Zealand. One of the largest species, common in Indo-China and the Malay Archipelago, is *Python reticulatus*, so called on account of the dark lozenge-shaped markings on the lighter ground of the skin. Specimens are known up to about 30 ft. long. Another species from the same region is *P. molrus*, also said to attain occasionally dimensions of 30 ft. The general colour pat-

tern is different, being greyish above with a series of large, reddish, black-edged patches. The under surface is yellowish and the sides greyish with spots with light centres. There are two species found in Africa, *Python regius* and *P. sebæ*, the latter being found in practically all districts of tropical and southern Africa, the former in West Africa. These species occasionally grow to 15 ft. in length, though generally they are much smaller. It is said that some natives reverence them and actually keep them in temples. Gadow records that a female specimen in the London Zoo laid a hundred eggs on one occasion. Their food consists principally of birds and rats. The Australian Python is *P. spilotes*, a particularly beautiful snake which lives much in trees and grows to 6 ft. long, although 4 or 5 ft. is, in the writer's experience, more usual. The general colour is yellow below and black with yellow dots above. This scheme is very variable, however, but the beautiful effect has earned for the snake the name of the "carpet snake." Mason, in his "Burma, its People and Productions" (London, 1882), tells an interesting and amusing Burmese legend as to why these snakes are non-poisonous. Apparently the Python was originally very proud of the virulence of its bite, and under the impression that if it bit even the footprint of a man that man was sure to die. As a test one day it bit a footprint,

and a crow was sent to the village to see how the man fared. The crow came upon the villagers holding a dance, and reported that so far from hurting people the Python's bite apparently produced joy. The snake was so disgusted at this that it spat up all its venom. Despite its non-venomous nature a Python can give a very nasty bite, apart altogether from its crushing powers.

The other subfamily is the Boinæ. Here there are no supra-orbital bones and the pre-maxilla is toothless. Further, the subcaudal scales form only a single row. Some fifty species are known, mainly in South and Central America, but genera occur in Greece, Southern Asia, Africa, Madagascar, and the South Sea Islands.

The most important species are the well-known *Boa Constrictor* and *Eunectes murinus*, the Anaconda, both of South America.

The first-named reaches a length of about 10 ft., though larger specimens have been found. Its colour is pale brown with dark spots above and yellowish under-surface. Similar specimens occur in Central America, the West Indies and Madagascar, *B. dumerili* and *B. madagascariensis* being the only constrictors in Madagascar.

The name "boa constrictor" has, of course, been applied in a popular sense to any constricting snake. The Anaconda is also a South American form, being particularly adapted to

its habitat in that it is both aquatic and arboreal and so suited to the well-watered South American forests. It is reported to attain a length of 35 ft., which is probably an exaggeration. Its habit is to lie just at the surface of the water or else hang from a tree over the water and seize its unsuspecting prey. The palæotropical species belonging to the genus *Eryx* are rather ugly creatures, with the head not distinct from the neck. As a rule they are of small size, from about 2 to 3 ft., and inhabit sandy places. They live upon small mammals such as mice, and their jealousy is remarkable. It is not at all uncommon for them to leave their own prey for that of another snake's, and frequently a number of snakes are to be seen wrestling together over some tiny mammal, while plenty other material of the same sort is lying unregarded close by.

It is said that young boas are easily tamed and make charming pets.

NON-POISONOUS SNAKES.

Tropidonotus natrix, probably the best-known member of this group is shown under British snakes. The non-poisonous snakes belong to several families and include many species. Indeed they comprise the largest section of the Ophidia. Most of them belong to the family Colubridæ, and to the portion of that family characterized by the possession of

ungrooved and solid teeth, known as Aglypha. Others are included in the families Xenopeltidæ and Amblycephalidæ. It is quite impossible to deal at any length with the very numerous members of this group, which has a great geographical range, and we must confine ourselves to the description of a few well-known examples. The range of the group is cosmopolitan and the habits of the members diverse. There are arboreal, aquatic, semi-aquatic and sand or rock-living species. Many like to bask in the sun, while others in temperate regions hibernate. Most of them are intelligent and are said to make good pets.

Tropidonotus viperinus is a common snake of France, Italy and Spain, and is so-called because of its resemblance to the viper. *Zamenis mucosus*, the Rat-snake of India, also is included in the group. It is an ill-tempered snake, growing sometimes to 8 ft. long. Other species worth mention are: *Zamenis constrictor*, the American Black snake. This snake, which may grow to 6 ft., is very irritable and will often attack people. It is quite harmless, and even its bite is negligible. Despite its name, it is not known to crush its prey. *Dasypeltis scabra*, from tropical and South Africa, is an egg-eating snake. The egg is swallowed whole, but is broken through the agency of the strongly developed hypapophyses of the throat region. The egg is broken and the contents

digested, while the sucked egg-shell is vomited up.

SLIGHTLY POISONOUS BACK-FANGED SNAKES.

This group contains those snakes which have in the posterior part of their maxillaries teeth with grooves on the anterior side. The grooves are connected with enlarged upper labial glands (see fig. 3) and the bite appears to poison or paralyse the prey. The snakes are not dangerous to man on account of the difficulty of inflicting wounds with teeth so far back in the mouth. Practically all the snakes in this group belong to the *Opisthoglypha*, a subdivision of the *Colubridæ*. The *Opisthoglypha* have a wide distribution, occurring also in Madagascar but not in New Zealand. There are arboreal, aquatic and purely terrestrial forms. One of the species, *Coelopeltis monspessulana*, is one of the largest European snakes, being 6 ft. long, although the tail is about 18 in. It hisses loudly when disturbed and strikes. Its bite is not serious to man, but small animals succumb in a few minutes. It is found in the Mediterranean countries.

VIPERIDÆ.

Actually the next group in the sequence is that of the deadly poisonous front-fanged snakes, but it is not illogical to deal with the Vipers here. For in them we find a condition not unlike that in the back-fanged snakes.

The Vipers, indeed, are back-fanged, but through the reduction of the maxillaries and an ingenious muscular device the back fang can be brought forward and be put to very dangerous use.

The maxillaries are very short and attached, movably, to the prefrontals and ectopterygoids. This allows them to be erected with their large poison fangs, which are the only teeth, apart from the reserve teeth, on the maxillæ. The method of bringing the teeth into action is seen in figs. 4 and 5. The succession of teeth here is continuous. Except for the Australian region and Madagascar the range of the family is almost world-wide, and terrestrial, semi-aquatic, burrowing and arboreal types occur. All are very poisonous. Two classes of Viperidæ are distinguished: (1) The subfamily, Viperinæ (Vipers), and (2) Crotalinæ (Pit Vipers).

The Viperinæ have no sensory pit externally between the eye and the nose. They are restricted to the Old World, with the exception of Madagascar. The Puff Adder belongs to this group and is an ugly creature with a yellow-brown series of markings, which give it some protection in its surroundings. Its food is young or small mammals, which it hunts at night. When it is threatened it hisses loudly and makes a puffing sound, which is responsible for its name. It does not bite readily, but when it does so it is usually

with fatal effect. The snake is found all over Africa, and reaches a length of 4 or 5 ft.

Cerastes cornutus, the "Horned Asp" of Egypt, is famous through the somewhat spectacular suicide of Cleopatra. This is a rather ugly snake a little over 2 ft. long with a horny, scaly projection above each eye. It lies usually in the day-time almost invisible in the sand. The "manufacture" of these snakes is now an Egyptian "industry," as the common unhorned asp is frequently adorned with sea-urchin spines and sold at remunerative rates to collectors.

The common Viper of Europe is *Vipera bera*, which is usually small, 2 ft. being more than the average length. In colour these snakes are very variable and may be grey, brown, red or black. Usually there are diverging marks on the back of the head and a zigzag line down the back, this latter character being often given as a reliable guide to the species; very often, however, it is quite indistinguishable. Males have usually darker markings, while females are usually the larger. The species is inclined to prefer heaths and moors, and especially copses or stony ground in such districts for its habitat. It lives principally on mice, which it hunts for at night. During the day, if at all sunny, the snakes may be found basking on stones or sandy patches. They do not climb or swim. During the six winter months they hibernate, usually in

numbers. They do not thrive in captivity, as they refuse food and generally starve themselves to death. Their bite is not usually fatal to man, although much depends on the concentration of the poison and the general health of the victim. Another, and dreaded, Viper is *V. russelli*, the "Daboia" or "Russell's Viper," which is one of the most deadly snakes of the Indo-Chinese region. This species is large, growing up to 5 ft. long.

The second subfamily, the Pit Vipers, is distinguished by the presence of a deep sensory pit between the eye and the nose on the skulls



FIG. 6.—Rattle of Rattle-snake.

of its members. Most members of this group also have a rattle at the end of the tail, due to the presence of a number of loose horny tail segments (see fig. 6). These increase in number with age, but many are also lost from time to time, so that the number of segments is no guide to age. The shaking of the tail thus produces a rattling sound.

The best-known member of this subfamily is *Crotalus horridus*, the common Rattle-snake. Other species of rattlesnakes also occur in North America, their size varying from 5 to 8 ft. Their bite is very dangerous. Like the

other vipers they prey upon small mammals, hunting them at night. Pigs, on the other hand, kill the snakes and eat them with avidity. During the day they bask, but rain is sufficient to send them to their holes. They occupy as a rule the holes of rats, prairie dogs or ground squirrels. During the winter they hibernate, usually in numbers. The tail is oscillated at great speed when the snake is annoyed, the resulting rattle-sound being rather like that of an alarm clock and sometimes very loud. The sound of the rattle depends of course on the number of "bells" and the condition of the snakes. It is said that a rattle-snake in a room makes conversation quite impossible. Unlike the common viper, rattle-snakes can be kept in captivity.

Rattle-snakes are confined to America, but other Pit Vipers occur in North and South America and Southern Asia.

POISONOUS FRONT-FANGED SNAKES.

To return to the Colubridæ, we find that the third great group is the Proteroglypha, or those snakes with the anterior maxillary teeth either grooved or hollowed for the transference of poison. The Proteroglypha, which range all over Africa, South Asia, Australia, Central and South America, are all very poisonous. The members of the group fall naturally into two subfamilies: the Elapinæ, with cylindrical tails, and the Hydrophinæ, with laterally compressed tails.

By far the best-known and feared genus of Elapine snakes is *Naia*. This genus has the head only slightly distinguished from the neck, but the neck region can be expanded into a hood by the spreading headwards of the ribs (fig. 7). *Naia tripudians*, the Cobra, varies considerably in colour, but is generally a yellow-brown with a black and white spectacle-mark on the back of the hood. The Cobra lives on rats, small birds, frogs and

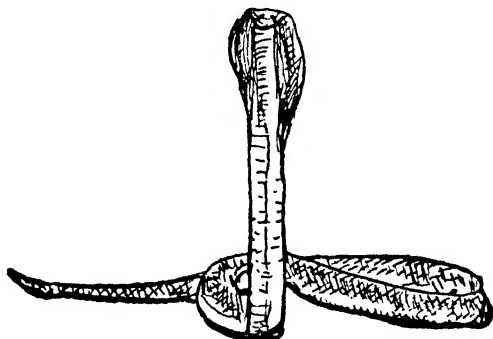


FIG. 7.—The Cobra.

lizards, and very occasionally fish. It hunts during the afternoon or evening and avoids the strong sunshine. Generally Cobras live in pairs, preferably in heaps of stones or wood or in deserted ant hills. They also have the unfortunate habit of being attracted to dwelling houses. The tail is short, being about 8 or 9 in. in a snake 5 ft. long. Six feet is a good length for a snake of this species. The Cobra is common in India, Burma, South China and

the Malay Islands. It is also found up to 8,000 ft. above sea-level in the Himalayas. Its bite is very dangerous, and cobra-poison is dealt with later under snake poisons.

More dreadful than the preceding is *Naia hanna*, the "Hamadryad" or "King Cobra." This snake has a very dilatable hood and occasionally reaches the great length (for a poisonous snake) of 12 ft. It is very ferocious and will attack man without provocation; further, its intelligence and speed are much greater than the Cobra's, so that it is almost impossible to escape it. Its food consists mainly of other snakes. It has a geographical range similar to that of the Cobra and is also found in the Philippine Islands.

Sepedon hæmachates is a South African hooded snake, popularly known as the "Ring-hals" or banded neck.

Probably the snake responsible for most deaths in India is the "Krait," *Bungarus cœruleus*, which is common all over India, especially in Bengal, and often enters houses, probably in pursuit of rats. It is usually 3 to 4 ft. long. *Elaps* is an American genus of this family. Although its bite is very poisonous, the small gape of its mouth renders it almost harmless to man.

SEA-SNAKES.

The sea-snakes belong to the second sub-family of Proteroglypha, the Hydrophinae.

They have the tail and sometimes the body strongly compressed laterally. All, with the exception of one species confined to a freshwater lake at Luzon, are marine. They are inhabitants of the tropical parts of the Indian and Pacific Oceans and occur along the Asiatic coast from the Persian Gulf to Japan, in the Indo-Australian seas, and along the tropical coasts of Australia, and in the Oceanic islands. One highly specialized species, *Pelamis platuris*, has been found far out at sea. Sea-snakes live entirely upon fish. Some appear to be diurnal and others nocturnal, but hundreds can occasionally be seen basking on the surface of the sea. They do not live long in captivity. All sea-snakes are poisonous, and the poison of one (*Enhydrina schistosa*) has been proved more virulent than that of the Cobra. Not all of them are fatal to man. In the sea they are graceful swimmers, but on land they are awkward and move with difficulty. Some species of the genus *Laticauda* live on land near the shore line, going down to the sea when hungry. Sea-snakes themselves are attacked and eaten by sharks and other fish and often are victims to birds of prey. The Hydrophinæ are viviparous, two to eighteen young being produced at a time. The female as a rule is larger than the male. The usual size of specimens is 3 to 4 ft., though considerably larger ones have been obtained. They are principally short and heavy, although

some may be extremely slender. The epidermis of sea-snakes is cast piecemeal and sloughing is a longer operation than in land snakes.

GEOGRAPHICAL DISTRIBUTION.

Some indication of this has already been given under the various families, sufficient at any rate to show that almost every part of the world has its snakes. The northern limit is that of permanently unfrozen soil, so that the northern stretches of Europe, Asia and the islands of the Arctic have no snakes. This also is true of New Zealand, where no snakes of any kind occur, at least outside zoological gardens or museums. Ireland, we are told, has had no snakes since the time of Saint Patrick. Grass-snakes are, however, occasionally reported from this fascinating island, although whether these escaped the vigilance of the worthy saint or were introduced later may be considered a moot point. It is a popular belief that Madagascar has no poisonous snakes, a statement which apparently can apply only to snakes dangerous to man. Members of the poisonous *Opisthoglypha* are known to occur. Unfortunately the fossil record of snakes is so unsatisfactory that it can throw no light on the interesting problems of Ophidian evolution and distribution, and it is quite likely that many of the vagaries of the latter must remain unsolved.

HABITS, LANGUAGE.

In this account of snake life it is well to emphasize some of the good points of snakes. We have dealt with their bad points at some length, and as a general rule it is best not to handle or take liberties with a snake, unless one is sure it is harmless. Taken all in all, the majority of the group are non-poisonous; and though many non-poisonous snakes are irritable, or cannot be kept in captivity, many are quite docile, and will in time make agreeable pets. Many naturalists keep harmless ones in their studies, where the snakes will generally find themselves a little hiding place, often behind books. There they will lie, coming out occasionally to see their friends, and popping out for a minute to take a brief glance at a visitor! They are very easy to keep, simple animal food and milk or water being all they require. I believe that before many years have passed, we shall find Snake Farms throughout all civilized countries, where good, healthy, harmless snakes will be sold for ridding warehouses, factories, wharves, custom houses, ships and various places of the troublesome rat, which costs millions of pounds a year. The picture facing page 1 shows the Australian Black Diamond Snake; he is a lovable fellow and quite harmless. It may be asked, "What use are snakes?"—a question that is difficult to answer. In the Animal Kingdom many groups are apparently of little

use, except as food to others, and as an interest to some scientific men. Undoubtedly they do keep down the number of rats and mice, which is quite a good service. Especially is this true in the tropics, where snakes, though chiefly poisonous ones, are attracted to dwelling houses by the vermin there. Now a live Cobra is not a welcome addition in a family, but at least it is an obvious evil, as against the insidious diseases produced or carried so commonly by these rats and mice in tropical climates. The non-poisonous snakes are equally good in hunting rats and mice, so that this must be accounted to their credit. From a commercial point of view, their main use is in providing skins which, on treatment, are capable of being made into shoes, bags and various trifles for ladies. The flesh of snakes has no particular food value, and the skeleton is of no commercial account. Perhaps, then, we must conclude that the group is not a very useful one, but that need not blind us to the fact that much of the evil attaching to the name is mere myth, and the superstitions raised by ignorance. The "poisonous forked sting" is a harmless sense organ; the skin is silky to the touch and not slimy, and many of the feared snakes make, as we cannot emphasize too often, quite interesting pets. At any rate, the way to study animals and to learn natural history is not by fear or prejudice.

What a great deal of harm is done by pre-

judice. The harmless slow-worm (*Anguis fragilis*) is considered by many to be a snake, and the natural antipathy towards snakes is so strong that anything in snake-like form is looked upon as being a dangerous pest which should be killed at sight.

The slow-worm is a small creature of about a foot long, and may be compared to what are termed the "Glass Snakes" of America and South-East Europe.

It has lizard eyes with movable eyelids, and is "viviparous," i.e., bringing forth its young alive from six to twelve at a time. They are a dull white at birth, but with age become a sable grey with a dark line running down the back, and later as they mature parallel rows of dark spots extend throughout the sides and back, the belly being whitish-blue.

They prefer dry ground, and take care to have a retreat in case danger is threatened. They live on worms and slugs, and so are very useful to gardeners or farmers. They suck the blood from the worm before swallowing it. It casts its skin like a snake, is found all over Great Britain, will stiffen its body if harshly handled, and fear will cause it to leave its tail in your hand in its efforts to escape, although a fresh growth will later take the place of the original.

The teeth are rather hooked, the tongue has a nick or notch at the tip, and the body is covered with small, close-fitting rounded scales. It hibernates in September-October,

and a winter sun may bring it from its slumbers to a quest for food, but the warmth of a summer's sun brings it renewed life in quickening its blood.

There appeared in *The Times* recently the following letter :—

Prejudice against snakes. Two days ago a friend informed me that his gardener had discovered that a heap of grass cuttings from the lawn was full of snakes! On my arrival I found that thirty-eight had been killed and that there were many more. They were all the common and harmless grass snake, varying in length from 2ft. 6 in. up to over 3 ft. The great majority were obviously about to lay eggs, and there were a large number of eggs already on the grass heap. My plea for no further destruction was unheeded, and ten more were subsequently killed. A good many more escaped into the wood. It was interesting that all the eggs I examined were recently deposited, and there were no little snakes about, so that apparently this large number of females had collected at the same approximate time for egg-laying.

The grass cuttings had been there only since last year, and were within fifty yards of the house. From the naturalist's point of view it was a slaughter of innocents, but the old prejudice still exists.

And so also does the opinion that snakes are silent, and that the only sound ever heard from them is a hiss. This is erroneous, as snakes can and do make sounds, and sometimes you would think they possessed as good a pair of vocal cords, as many other animals. You can sometimes hear a snake bleat like a kid, at other times like a deer, at other times like the purring of a cat, whereas some make a belling sound, and more frequently a long, rather metallic sound like the wind driving through a wire.

Snakes have their own language like all other animals. Take our own domestic dog, which almost everyone can study if they so wish, and see what Lindsay says upon this subject. There is the language imparted by the tail and the ear, and also by the eye and the look, and further by the voice in the whine, sniff, bark, howl, growl, snarl and snap. Then there is the language of aspect, movement, gesture and general attitude, opening the mouth, putting out the tongue, &c. The howl of the dog may be occasioned through bodily pain, loss of its master, or locality, anger, despair, grief, disappointment, discordant or melodious music striking on its sensitive ear, expostulation or mere impatience. All these points need careful study, and it is not surprising that it should frequently be either difficult or impossible for man to be certain that his interpretation or construction of the

conduct or look of this or that animal is correctly read and understood. And further that there should arise even among those who have studied animal language—including eminent authors—irreconcilable differences of opinion as to the meaning to be attached to different sounds, attitudes, or actions.

Many animals possess and exercise the same power that man has of controlling or repressing their feelings—for instance of bodily pain—when a sufficient motive for doing so exists. This power of self-control—of stifling emotion, of inhibiting or preventing all outward expression of the fear or other poignant feelings which nevertheless exist—is illustrated in many common feints, the object of which is to escape danger or death, in many snakes, dogs, and birds. Nor is it always or ever easy, especially for a novice, or for anyone unacquainted with the mental character or physical peculiarities of species—with the individuality of some of its members—to discriminate between the real or natural, and the false or feigned expression even of feature.

For certain dogs at least can assume—as man so constantly does—“company manners”—a behaviour in the society or presence of man, or of particular men—that do not represent their true feelings or thoughts, but are the result of conventionality and constraint. It is quite common, again, for the guilty but quick-

witted dog to assume the aspect of ignorance or innocence, and it may require long and close watching to detect—and only when it believes itself unwatched by man—the little signs by which it betrays itself—the furtive look, the slinking gait, the avoidance of man.

And there are other animals quite as capable as man is of assuming, for the purposes of deceit, such looks or mien as will serve to throw man himself, or their animal enemies or prey off their guard.

While, as a rule, and especially in young animals, there is an obvious outward demonstration or demonstrativeness of feeling; and while also there are cases—mostly in mature and experienced animals—in which there is, for some specific purpose, a successful repression of emotion, there are certain other cases in which there is simply, for various reasons, a non-expression of wants, desires, ideas. Such animals do not give natural vent to their feelings; they are not naturally demonstrative; they are what in man would be called cold and self-contained, stolid, indifferent, impassive. This condition, however, when it exists, is generally the fruit of mental defect or disorder, or in other words, it is morbid in its character.

Such animals find their human analogies in many savage races, and in many individuals among civilized peoples.

As I have explained in "Big Game and Big Life," it requires much patience in watching

Elephant, Rhinoceros, Hippopotamus, Lion, Leopard, Bear, Snake, Crocodile and all other animals to see their ways when they think they are unwatched by man.¹ Here you see them in the natural state, but directly they become aware of the presence of man their actions are changed. The movements of the head, neck, throat, or breast puffing, swelling, dilatation, or distension, assume quite another character.

It is inherent in animals to have distinct conceptions of the nature and nearness of danger, including a very decided recognition of enemies, and it results in the various means adopted for concealment or escape from or deception of them.

Among the many supposed points of difference between man and animals is his use of tools and weapons, of instruments of all kinds. But such a belief and such an allegation are the obvious errors of thoughtlessness, for very little consideration is required to show that animals use either their whole bodies or portions of them—such as the back, shoulder, arms and legs, fingers, toes or claws, hands, paws, hoofs or feet, cheeks, mouth, jaws or teeth, beaks or bills, nose, proboscis, mandibles or antennæ, heads or horns, spines, fins or flippers, tails or wings, spurs or other appendages—either as tools or weapons, as circumstances may require.

¹ "Big Game and Big Life." Published by E. P. Dutton and Co., Inc., 286-302, Fourth Avenue, New York, N.Y.

When recently lecturing in America upon Zoology, I met a lady who had read an advanced copy of this book which my publishers had sent to me. She told me that she wished the book had been used in their schools from her girlhood, but hoped it would soon find its way there. She went on to say that she thoroughly understood my plea for the harmless snake which was useful to man.

She said she had an estate in Virginia, upon which was a granary infested with rats.

After a time they found that the granary was free from rats, but could not account for this.

A few months later a coloured boy who worked on the estate discovered a snake just descending from a hole in a tree near by the granary. The marks from the hole to the ground showed that the snake had made many journeys to the granary. He fetched his gun and, waiting his opportunity for the reappearance of the snake, shot it dead.

Within a short time the granary was again overrun with rats! The boy had killed a true friend.

It is unlikely that he will ever realize the practical value of the friendship he destroyed with the snake's life, for mankind seems unable or unwilling to take cognizance of the widespread harm caused by the rat. Otherwise we should see greater efforts made for the extermination of this universal pest.

A few words on the mischievous activities

of the rat may not be out of place here. The poultry farmer knows him as a feeder on eggs and birds, and generally takes measures to limit his depredations. The general farmer is likewise aware, but more apathetic. When questioned as to the harm done by rats, he admits it, but often shrugs his shoulders as if to signify that the rat is an ineradicable evil that will always be sent to plague him. Perhaps he keeps a terrier and enjoys the sport of an occasional afternoon's ratting; sometimes he will make an effort to stalk some particularly cunning old rat which he has succeeded in identifying after it has done sufficient damage to arouse him from his tolerance of its species. But it is seldom that he makes serious efforts to exterminate the rat colonies on his property.

And yet we can hardly blame him. His single-handed efforts might free him from the pest for a time, but sooner or later he would find his buildings overrun with rats migrating from his neighbours' premises in search of sustenance. Let it be remembered that the rat is one of the most fertile breeders of the animal kingdom, the female giving birth to four or five families in a year. Thus at least once a quarter she burdens the world with from four to ten reproductions of her species, who in their turn are able to give birth to similar families when they reach the age of six months. This is an alarming rate of multiplication.

In addition to his diet of poultry and eggs the rat is a great consumer of grain. It is estimated that every full-grown rat devours yearly £1 worth of food destined for human consumption, and to this bill must be added the damage his teeth do to fences and buildings. The Duke of Sutherland in a speech recently delivered, said that the total yearly damage caused by rats in Great Britain amounts to £66,000,000. This is a careful estimate, but the true sum may be even greater.

Can anything be urged in defence of the rat? Are there any mitigating circumstances that might lead us to a partial condonation of his ravages? We know that some so-called pests have compensatory qualities, as, for instance, the wasp, which makes heavy inroads on our fruit crops, but atones to some extent for the loss he causes to mankind in this direction by preying on other insect pests such as certain caterpillars which would do inestimable damage in gardens and orchards unless checked.

The mole, too, seldom finds a good word from farmers, most of whom hunt him down remorselessly, and there is no doubt that his burrowing operations do much harm to crops. But not long ago I read of a farmer who, after killing a mole, dissected his corpse and found the stomach full of wireworms. At once he realized that he had killed a true friend and

vowed never to harm another mole as long as he lived.

But no such redeeming qualities can be pleaded in extenuation of the rat's offences. Neither for food, pleasure or self-defence is he known to destroy any other enemy of mankind; he therefore offers no compensation for the damage he does. Furthermore, he is said to be responsible for the loss of many human lives as a bearer and disseminator of plague.

The rat that is the cause of so much damage¹ is *Mus decumanus*, known as the Brown or Norway Rat, although his original home appears to have been somewhere in Central Asia. Like the thistle in Australia and the blackberry bramble in New Zealand, *Mus decumanus* is a typical example of the harm that often occurs when animal or vegetable species are transferred from their native homes to localities where Nature never intended them to go. Travelling as an unbooked and unwanted passenger on board ships ever since the art of navigation was first practised by man, the Brown Rat has formed colonies in every part of the world. He is easily acclimatized; from the shores he forces his way inland. He prospers and multiplies; he repays his hosts for their hospitality by

¹ "The Rat: a World Menace," by A. Moore Hogarth., F.E.S. Published by John Bale, Sons & Danielsson, Ltd., London, W.1.

doing them injuries that mount into millions of pounds yearly.

Only during the latter years of the war, when the German submarine menace made the food question a vital one for the British Isles and forced us to economize in many unsuspected directions, did the depredations of the rat receive official notice. From those times we have a legacy known as "Rat Week," which usually occurs at the beginning of November. Notices are prominently displayed to call attention to the damage done by rats and mice, describe their favourite haunts, and tell us what measures the good citizen should take to free his premises from the pest. There is also a hint of the penalties in store for the bad citizen who facilitates the breeding of rats by allowing refuse heaps to accumulate, etc.

There is no doubt that many rats and mice are killed during this one week of the year. But they are only a small proportion of the hosts that infest our country and, too often, alas, are allowed full liberty to practise their destructive habits during the remainder of the year. If the rat and the mouse are to be exterminated from the British Isles, every week of the year must be a "Rat Week."

How are we going to deal with the rat question? It has been predicted that the rat will cover the whole earth, and I have found it making headway across Africa, and also in

many other parts of the world where it has travelled far into the interior.

In my efforts to introduce the harmless snake into the list of domestic animals, I have little doubt that, although I have been sowing the seeds of this necessary reform in the animal kingdom, it will probably not bear fruit during my lifetime.

I predict that there will be snake farms in every civilized country, where harmless snakes will be bred and trained, and where they can be purchased for the purpose of destroying rats and mice.

These farms will serve another purpose also. They will be an educational factor throughout the country, and many thousands of people will visit them, and become acquainted with their habits.

Not only will farms and country houses keep their snakes, as they now keep their dogs, but they will also be found in many town and city houses, where they will be pets of the family, and also keep the houses free from rats and mice.

Men (shall we call them OPHIOLOGISTS?) will be specially kept in certain buildings for the care and supervision of snakes. Large docks, wharves, custom-houses, warehouses, stores, granaries, and such places will require many snakes and keepers. I will not include liners, as it may save some reviewer from displaying his wit by causing a panic among passengers through having snakes aboard!

If we imported to this country some harmless snakes, of the type killed by the negro boy in Virginia, we should have the assistance of an army of valuable allies to wage incessant war on the rats. But it is likely that an ignorant public would be more ready to slay its friends than its foes, judging from the fate that not so long ago befell a British Grass Snake, a harmless reptile that preys upon the rat's equally destructive kinsman, the mouse.

I saw a placard in the City of London recently with a line in heavy type, "Snake in a Stamford Hill Garden."

I purchased the paper and found that a woman, into whose garden the tame pet belonging to a neighbour had wandered, was described as courageous, and the situation as alarming.

The snake was coiled up on the path, and the cat was making cautious investigations, but showed by its quick retreats that it lacked courage. The snake was well beaten with a stick, and buckets of boiling water were emptied over it—and so the poor harmless little grass snake was done to death.

I wrote a letter to the paper stating that I knew what the snake was seeking, and that it would not have hurt anyone, and pointed out the use of the harmless snake.

Two days later, another writer in the same paper, in referring to my letter, related the following:—

A relative of mine living in the country was, when a child, permitted to take her supper of bread and milk into the fields on summer evenings. A snake with which she had made friends used to come regularly and share her repast, the girl giving signal by striking the side of the basin with a spoon. She used to stroke the head of her pet, and use words of endearment, which the snake evidently understood as a term of goodwill, and he would at any time come out of his hiding place when he heard his little companion approaching and manifest pleasure at meeting her.

A recent episode has reached me from Melbourne concerning a Tiger Snake, one of the venomous kinds found in the Australian continent. This reptile was found in the company of a twelve months' old baby, sucking away contentedly at the rubber teat of a feeding-bottle, while the infant stroked its head. The alarmed father chased the snake away, and then tried to kill it, when it attacked and bit him. Eventually it was killed, and emergency measures saved the man's life.

But the child's parents had previously noticed that many nipples of the bottle were recently bitten through. They had been puzzled to account for the circumstances, which now, however, pointed to the conclusion that the snake and the baby had been playmates for some time.

I can understand their anxiety which cost the snake its life, but I nevertheless wonder whether any harm would have come to their infant. Most snakes only bite in self-defence, and this particular specimen must have realized that he had nothing to fear from the baby. It would seem to me that his reasoning power told him that as long as he did not abuse his privilege he was assured of an easy supply of the milk he relished. A daring hypothesis, some may say, but perhaps a justifiable one when we know more about the minds of animals in general and snakes in particular. Besides, why should the snake be credited with malevolent intentions towards the baby when all available evidence tended to prove the contrary?

Several snakes have become affectionate, docile drawing-room pets—for instance, those of Chelsea, described by Buckland. They were the playfellows of the children of the family; knew individuals; pined, by refusal of food, in the absence of their master, and kissed and embraced him on his return, enjoyed fun, and showed signs of pleasure and joy.

Certain Indian snakes are called “dancing” snakes for their delight in movements in concert with music, displaying a knowledge of musical time, as well as of tone or tune. They are enticed or lured from their nests by music in the so-called process of snake-charming.

Snakes come sooner or later to know their

masters or mistresses, those who are kind or cruel to them, from all other persons, and their behaviour to strangers or enemies is very different from what it is to those with whom they are familiar or friendly.

The following is from the *Mudgee Guardian*, New South Wales :—

At . . . (a) . . . dairy a unique battle between a snake and a cat was witnessed. The reptile was making its way across the yard when pussy spotted it and immediately sprang on to it. She grabbed the head of the snake in her mouth and, while the snake coiled its 5 ft. of wriggle round the cat's body, pussy simply laid down and waited. Then she bit the crawler's head off, spat it out and calmly walked off, as if it were an everyday occurrence with her.

This is what I explain in "Big Game and Big Life" of the fear a horse has of a wolf where the scent is unknown to the former, and this is why the cat in the Stamford Hill garden was frightened of the snake which was unknown to her, whereas the Australian cat was evidently frequently handling them, and there was an absence of fear.

The sacred Kingfisher bird of Australia kills small snakes by beating their heads against a stone or other hard substance.

A girl can seldom be sure that she loves until she is sure that she is loved.

And so with the snake which has been as persistently hunted as the African elephant, or the lion, and which looks upon man as a natural enemy.

But when affection is shown towards the hunted, and which can be so easily done with the harmless snake, that affection is returned, and grows deeper and deeper. This you will see most perfectly exemplified in the case of the Lion, Tiger, Leopard, &c., in the Zoological Gardens, London, towards their kind and painstaking keepers, who bare their arms and place them in the mouths of these wild animals who have lost all fear of man, and know him only as a true pal. I have seen many of the zoological gardens in the world, and have seen with much pleasure and appreciation the advancement that has been made at the London Zoo under the capable and untiring efforts of the present chief, Sir Peter Chalmers Mitchell.

NORTH AMERICAN SNAKES.

The Continent of North America is favoured with a variety of geographical types and of fauna unrivalled almost anywhere else. The snakes, too, show this diversity and both large and small, poisonous and non-poisonous kinds are to be found. In the preceding pages we have seen something of the general characters

and habits of this group of reptiles, and I have drawn up, and used, a rough classification. Enough has been said to show what is to be feared from, and what is admirable in, snakes, but further space may well be devoted to the discussion of the kinds found particularly in the United States of America and in Canada. This is intended to meet the needs of the youthful student, and of the general lover of nature. It is not desired to surpass but rather to lead up to, the standard zoological works on the subject. It is none the less hoped that the book will form a useful pocket guide, and a readable one at that, to the common snakes of North America, and that sufficient information will be given to assist the seeker after knowledge, or ordinary traveller, who may be unfortunate enough to be bitten.

We shall preserve the order and classification given on p. 34, and in order to suit those with little zoological training technical terms will be used as little as possible.

Burrowing Snakes of North America.

The snakes which burrow or lead a partly subterranean existence are drawn from many groups in North America. Firstly, the true burrowing snakes belong to the family Glauconiidæ, or Leptotyphlopidae, and to the two genera of it. The first of these is known as *Anomalepis*, which has one species in Mexico;

the second is the much larger genus called *Glauconia*, which has several well known species in the United States, for example, the Texas Blind Snake, and the Californian Blind Snake. These snakes are absolutely burrowing and live in long tunnels or in ant-hills. They are quite small—about a foot long in quite large specimens—and are blind. Actually they have small eyes, but these are of little use except perhaps in reacting towards bright light. The head is very little broader than the neck, and the tail is very short. As a rule they feed on insects and worms. They are quite harmless to man. The snakes are really tropical, and are found in North America only in Mexico and the Southern and warmer parts of the United States. Both the Texas and Californian Blind Snakes are brownish on the back and whitish on the belly. To all intents and purposes they look like smooth worms.

As indicated in the previous pages, members of the families Leptotyphlopidae and Typhlopidae are found in the warmer parts of America, often living in white ants' nests. These snakes are quite harmless to man.

These are the strictly burrowing snakes, but many other North American snakes, both harmless and poisonous, lead a partly underground life. We shall mention these as we come to them.

Constrictors.

The constricting snakes have also been described in general outline in the preceding pages and some idea of their habits and distribution given. The family is called the Boidæ and is subdivided into two, the Boinæ or Boas, and the Pythoninæ or Pythons. They are all non-poisonous and crush their prey. The North American kinds are, with one exception, Boas, but one python is noted from Mexico. There are four common Boas in the United States, all of them quite small, less than a yard in length. They are fairly well known under their common names. The largest comes from South California and Arizona, and is known as the Rosy Boa. This snake grows to about a yard long, and is brownish on the back and rosy red or yellowish brown underneath. It has a long head, little different in width from the neck, and with large eyes. Another Boa from Southern California is the Three-lined Boa, so-called because it is brownish with three dark lines or stripes all along its back from snout to tail. Both these snakes belong to the genus *Lichanura*.

The other genus of the family Boinæ in South America is called *Charina*, and also has two species. The best known of these snakes has a wide distribution from Southern California as far north as Washington, which is very far north for a constricting snake. It is not a large snake, eighteen inches being about

its maximum. It is peculiar in having a tail almost as blunt as its head and for this reason it is known as the two-headed snake. Sometimes the snakes will twist themselves up into almost a ball, and this fact, coupled with the brown or olive colouring of the back, has earned for it the name of Rubber Boa. It is thought that the snake is burrowing, and it can be kept well in captivity, and may be fed on small mice or birds. It kills, of course, by constricting.

The member of the Pythoninæ is a Mexican snake, *Loxocemus bicolor*.

Non-Poisonous Snakes.

The majority of snakes belong to this class, and most of them to that part of the family Colubridæ, characterized by the possession of solid, ungrooved teeth and known as Aglypha. On account of their teeth they are non-poisonous and quite harmless to man. The group includes most of the common snakes and has a wide distribution. The habits of the Aglypha are correspondingly diverse even in the North American area, where some ninety species are recognized. The largest genus is *Tropidonotus* (or as it is now more correctly called, *Natrix*) which comprises what are known as the Water Snakes. This name is applied because the snakes frequent the banks of rivers and streams and the shores of lakes. The water serves as a means of safety for them

and all are good swimmers. Their food consists mainly of cold-blooded creatures such as frogs, toads, and fish. The last-named are usually caught by the snake's belly. Although the snakes are toothed the bite is not at all serious to man. The young are brought forth alive, that is, the genus is viviparous. Generally the snakes are recognizable by their stoutness and the strongly-keeled scales. The largest of the North American water snakes is the Brown Water Snake, or "Water Rattler," which is very ugly and of an irritable appearance. It is rather easily frightened and old snakes are especially difficult to catch. For this reason it is difficult to give the maximum size the species attains. An average specimen is about 4 ft. long and 2 in. in diameter. The head is about 2 in. long. The colour is a rusty brown with black squares on the back and sides, and yellow with brown spots on the belly. The snake is thus given a banded appearance. They have a habit of coiling somewhat like a rattle-snake, and this, with the banded appearance, earns for the snake the name of rattler. Many young are born at a time. This particular species (*Natrix taxix pilota*) is abundant in Georgia, Carolina and Florida.

The common banded water snake, or so-called "Moccasin," is *Natrix fasciata* and has many varieties. Usually it is about 4 ft. long or slightly less, of a black, yellow, even olive-

green colour, and has a stout body and rather flat head. The range of the typical species is from the Gulf of Mexico to Virginia. It is common in Texas and Florida. It is also shy and readily seeks safety in the water on any alarm. It feeds chiefly upon fishes, though frogs are also taken. When cornered it assumes a terrifying attitude and looks dangerous, and it will also exude an ill-smelling fluid. The creature, like the other water snakes, gives birth to large numbers of young, sometimes as many as fifty.

As the name shows, the snake is quite often confused with the true, and dangerous, Moccasin. The chief differences are as follows: the poisonous creature has a large pit between the eye and nostril, while the *Natrix* has none; the under surface of the tail in the Moccasin has *one* row of plates, the false moccasin has two; the harmless water snakes are thinner and have red spots on the belly. This last is very characteristic. The numerous varieties of the snake make it very common and widely distributed in both Canada and the United States.

The next genus of harmless snakes that is abundant in North America is *Eutænia*, though it is much better known as the striped or garter snake. They obtain their name from the three rows of stripes, one on the back and two on the sides. These stripes are usually of lighter colour on a darker background, but

the colour variations are so great that it is difficult to define any typical appearance. The range of the members is very great, indeed they occur in every place in North America frequented by snakes. In many ways their habits resemble those of the water snakes and they often seek refuge in water. They live also on cold-blooded creatures; fishes, frogs, toads, and worms. They produce a large number of young. Since so many species occur in the genus, and such variety of colour exists, it is not easy to give a ready method of identifying the snakes. The key to the species furnished by Ditmars differentiates them on colour, build, and length of the tail, together with the number of the scale row on the sides on which the stripes appear.

The Common Garter Snake is *Eutænia* (or *Thamnophis*) *sirtalis* and has many varieties. Mature specimens are stout and about 2 ft. to 3 ft. long, but young specimens are slender. So far as colour is concerned, the snakes may be black, brown or olive on the back with the central stripe yellow or green or even whitish. Often the side stripes cannot be well seen as they merge into the paler colours of the abdomen. Some specimens have all the stripes absent. So numerous are the various kinds of garter snakes that it is impossible in the space devoted to them here to give any account of the local variations. Speaking generally, the snakes are widely distributed in the New

World. They are to be found in Central America, and far to the north in Canada. They are late in returning for their winter's sleep and are out again early in spring. They are usually to be found in numbers on slopes facing the south, where they love to bask in the sunshine. They hibernate in burrows and before the frost sets in in the fall, and early in spring they come out for short spells in the sun. In spring the groups set out for the thickets and ravines they usually occupy, leaving the rocky shelter, burrows and snake holes deserted. Often this "emigration" takes place in numbers, and the writer remembers one incident in Canada where some thirty snakes were lying flattened and dead after a heavy motor wagon had run over them while crossing the road from the snake holes. Although frequently one hears of the "dangerous" nature of these snakes, it must be stressed that they are quite harmless and make good pets. When first taken into captivity they make themselves unpleasant by discharging offensive-smelling material, but soon they become quite tame, and even, it would appear, can distinguish people. Being hardy and thriving well on earthworms they are easy to keep. Earthworms, indeed, are the first food of the young, and it is not till later that they take frogs and toads. Those that frequent water also take fish. Mostly they are very greedy eaters. The

young are produced alive, and are usually born about the fall, sometimes in broods of fifty. They look after themselves at once. The adults are naturally shy, and most species are to be found in the country, but some have been reported from parks in Philadelphia and New York.

The next largest group of non-poisonous snakes, so far as number of species goes, is that of the King Snakes. These are constricting snakes of variable size (from a little more than 1 ft. to 6 ft. long) belonging to the genus *Ophibolus*.¹ They are interesting snakes, often of beautiful appearance and of some economic value, and they derive their popular name from their habit of killing and devouring harmless and poisonous snakes. Their economic importance consists in the fact that they destroy rats and mice and poisonous snakes, though they are equally liable to kill other harmless and economically useful snakes. Although towards other snakes they are very fierce they do not attack their own kind, and although often bitten by deadly snakes the poison does not seem to affect them. They kill by constricting and crushing their prey, but they belong definitely to a branch of the family Colubridæ and are not constrictors of the class of the Boa and Python. They are hardy snakes and towards man are quite

¹ The majority of the species are (by the latest authorities) referred to the genus *Lampropeltis*.

inoffensive and not even very irritable. Thus, they too can be adopted as pets and will live for years in captivity.

The seven species of the genus show great variation in size and colouring, but as a rule they are all stoutish snakes with smooth and highly-polished scales. The head is not very distinct from the neck and is comparatively small.

The distribution of the group is wide and King Snakes range on the east from New Jersey and Minnesota to Florida, and on the west through California, Arizona and Texas into Mexico.

Space necessitates that we should deal with only three common kinds of this fascinating genus. Firstly, *Ophibolus getulus*, the common King Snake, also known as the Thunder Snake, which can be found all over the Southern States. It reaches a length of 6 ft., but, again, many varieties occur. Most of the specimens are black with chain-like yellow or white markings on the back, so that sometimes the creature is called the Chain Snake. The belly is black with quite large white or yellow patches. This particular species lays eggs. An outline of the habits of the King Snakes has already been given, but it is this reptile which has been most studied. It is quite relentless in its struggles with other snakes, but it does *not* look out for them or pursue them. Only when it comes across them does it

quarrel and kill. It is interesting to note that while many snakes are poisoned by venomous snakes, the King Snake is quite unhurt. Apart from the snakes its diet of rats and mice make it a useful creature, and quite often it will keep granaries and farms free from these destructive pests. Towards man it is quite amiable and is easily kept, as it is hardy and will eat dead as well as living food.

The most beautiful species, indeed one of the most beautiful of all snakes, is the Arizona Ringed Snake, or the so-called Coral Snake, *Ophibolus zonatus*.

The head is distinct from the neck and has a black snout with, behind it, a white band going across the temples. A black ring is placed behind this. The body is ringed with red, black and white marks, the black and red being more prominent. Of all the varieties the Californian kind is probably the most handsome and the largest. Specimens vary between 2 ft. and 3 ft. in length. The real Coral Snake is poisonous but the King Snake differs in the arrangements of the colour bands.

The Milk Snakes are varieties of this genus also, so-called because of the idea that in their search around farms for mice and rats they attack cows and steal milk. This idea is largely superstition as the snakes drink very little of any fluid and show no preference what-

ever for milk. The species is known to the student as *Ophibolus doleatus*. The snake has a grey back, spotted with brown and black, and a grey underside. Three feet is a good size for an adult. The snakes are useful because they eat rats and mice. Unfortunately the superstition that they milk cows causes farmers to kill what is really one of their best friends.

Towards man the snake is not so friendly as the others. Sometimes it bites, harmlessly of course, but it cannot be kept in captivity well.

The next genus is that which gives its name to the whole of the family—Coluber. They are Aglypha, and so non-poisonous snakes, but they kill their prey by constricting, or crushing, them. They are usually of quite large size, and as they prefer rodents for food, they are commonly called "Rat Snakes." They are very abundant and have a wide range over the United States. Their colours and habits vary greatly. Generally they live in fields where the smaller mammals and birds are common. These they destroy to the benefit of the farmer, who usually responds by callously killing them. This entirely stupid destruction is much to be deplored, as it is an easy matter to learn to distinguish snakes.

The stoutest of the Colubers, if not the largest, is the Fox Snake, *Coluber vulpinus*, so-named because it has similar habits to the fox. It lives on small mammals—rats, mice and rabbits, but sometimes will swallow eggs.

The shell is broken by the contraction of the ribs of the snake (see p. 49). The snake is not a tree living one like most of the Colubers, and grows to about 5 ft. long. It lays eggs, and makes a hardy if sometimes irritable pet.

Another interesting and beautiful snake of the genus is the red Coluber, also known under many other names—Mouse Snake, Red Chicken Snake, &c. The back of the creature is pale red with crimson markings, while the belly is white with black squares. It is very common in the south-eastern States and adults grow to 4 ft. or more. It is fond of rabbits, rats, and especially mice. It will climb trees for small birds, but generally it is not so arboreal as most Colubers. It is good tempered and makes a good, as well as a pretty, pet.

The Pilot Black Snake is another Coluber found over a wide area in the United States. It is commonly mistaken for the true Black Snake. The back of the snake is a lustrous black, while the underside is a pale grey or white. The name is due to the superstition—it is nothing more—that this snake gives warning to other snakes of the approach of danger and pilots them to safety.

The true Black Snake belongs to the genus *Zamenis* and is often known as the Black Racer. The genus consists of snakes known as Racers on account of their speed. *Zamenis constrictor*¹, the Black Snake, has a head

¹ Now known as *Coluber constrictor constrictor*.

slightly distinct from the neck, and with large eyes. The body is slender and the tail long. The colour is generally a slate-black in the adult with the throat white. The young individuals are quite different from this, being grey above with dark spots on the back and sides. Gradually they become darker and in the third season or so they are the colour of the usual adult. The Black Snake will grow even longer than 6 ft., but a foot less than this is a more usual occurrence.

The snake is also one of those invested by legend with strange powers. There is no need to repeat legends of its speed, constricting powers and ferocity, yet most of them are quite untrue. It is a speedy creature and very hardy, but it is quite harmless to man. It attacks and devours other snakes but is the "sworn enemy" of none. It also lives on mice and other small mammals which are found on the edges of the meadows, which it likes to frequent. It does not, in spite of its name, constrict its victims. When cornered it is a very irritable creature, but soon it becomes good natured in captivity and will learn to eat from the hand of its keeper without fear. The species is commonly found on the Eastern and Southern States, and various varieties are known. The snake is oviparous, that is, lays eggs. Other members of the genus are the Blue Racer, the Red Racer, the Whip Snake, &c.

Numerous other genera are comprised within the wide term Aglypha, and it is not possible to deal here with the large number of genera and species of them. We may, however, mention as the more important genera *Contia*, which consists of small, smooth-scaled snakes of a foot or so in length, found in Arizona, Texas, and Mexico. Such snakes as the Yellow Ground Snake, the Banded Ground Snake and the Pacific Brown Snake are of this genus. The Ring-necked snakes, also small, smooth-scaled creatures, belong to the genus *Diadophis* and are to be found in various regions of East, West and Southern North America. The last genus we need devote space to is *Pituophis*, which contains the Bull Snakes. These are large snakes (5 to 6 ft. long) closely allied to the Rat Snakes, and like them, they constrict their prey, which consists of rats and mice. Thus the snakes are useful to the farmer. They are easily recognized as large white or grey snakes with dark spots on the back: they have pointed heads and can produce, owing to the peculiar mechanism of the throat, a loud hiss. They are quite widely distributed over the United States. They are egg-laying.

All the preceding snakes, with some others we have no space to mention, are quite harmless to man. It has been stressed occasionally in their description that, on the contrary, they are quite useful, especially to the

agriculturalist, as not only do they destroy the harmful snakes, but they destroy the small mammals which cause much depredation to the farmer's crops. Thoughtless killing of these reptiles is much to be deplored, and the excuse that "a snake is a snake" is not really sufficiently good. Apart altogether from their useful qualities, we have frequently seen that these harmless snakes make interesting, hardy and easily kept pets.

Slightly Poisonous Back-Fanged Snakes.

The next group of snakes under our classification is that in which the creatures have grooved teeth, the groove being connected with a poison gland. In this particular group the groove is on the front side of the back teeth, so that the snake must have a very good hold of its victim with the back teeth before a poisonous injection can take place. As the grooves and glands are usually small the bite of such snakes is not dangerous to man, producing at the most only local symptoms. The snakes now mentioned are, however, poisonous, and should, in one's mind at least, be strongly differentiated from the preceding ones. A brief description of the characters of the group has already been given on p 50.

The North American snakes of this type belong to only a few genera, and of these notice need only be taken of two more than usually

poisonous genera, *Sibon* and *Trimorphodon*. Since a snake usually strikes at a man, it is unusual for the Opisthoglyph snakes to cause much damage, but if, on the other hand, in being taken hold of by man it manages to hold and chew his fingers at least local poisoning will ensue. The effect on prey is much more marked. Usually complete paralysis sets in in a minute or two, death being a matter of five minutes. The prey is then swallowed without difficulty.

Since we have mentioned *Trimorphodon* and *Sibon* as the most dangerous of these slightly poisonous serpents a brief description of them may be given.

Sibon serpentinalis, or the Annulated Snake, is a rather slender, greyish creature between 2 ft. and 3 ft. long. It is to be found in the more southerly States, Texas, Arizona, New Mexico and southwards of these. The head is much wider than the neck, and the large eyes have quite obvious elliptical pupils. The creature is rather shy and feeds on young snakes, frogs, lizards and mice.

Closely allied to *Sibon* is the genus *Trimorphodon*, the best known species being *T. lyrophanes*, the Jew's-harp snake, so-called because of the brown, harp-like patch on the head. In size and habits the two genera are closely similar and the several species comprised in each are essentially Central American in habitat. Both are distinct because of the

elliptical pupil, giving them a sort of cat's eye. Although they will live, feed and lay eggs in captivity, they are somewhat secretive and irritable.

This group, the Opisthoglypha, is the second division of the great family Colubridæ. It would be more appropriate to follow their description with that of the third division of the family, but for the reasons stated on p. 50 we prefer here to treat the family Viperidæ.

Deadly Poisonous Snakes.

Here we have a family of normally back-fanged snakes which can bring the fangs forward for their deadly use. Their mechanism is described on the page mentioned above, and illustrated on p. 26.

The group is composed of perhaps the most feared and most deadly of all snakes. Fortunately, by one device or another they are fairly readily distinguishable. The Viperidæ, as we have seen, are divided into two subfamilies: (1) the Viperinæ, or Vipers; and (2) the Crotalinæ, or Pit Vipers. The former are confined to the Old World, but the latter are found generally distributed throughout America. The name "pit vipers" is given on account of the sensory pit which occurs between the eye and the nose of the Crotalinæ, and is absent in the Viperinæ. The Crotalinæ contains the well-known and highly poisonous rattle-

snakes, the Copperhead, the Moccasin and the "Fer-de-Lance."

Since it is the Rattle-snake, or Rattler, as it is commonly called, which is probably best known of the poisonous serpents of North America, it will be best to deal with it first.

Some sixteen or more species or subspecies of *Crotalus* occur widely distributed over the United States and Mexico. They are easily distinguished by the presence of a rattle on the tail, which has been sufficiently described and illustrated on p. 53. The rattle comes with age—young snakes have none—and seldom reaches more than eleven segments. Rattle-snakes of the genus *Crotalus* attain a length of up to 8 ft. and are easily distinguishable on account of the spear-shaped head with small scales, and the quite obvious rattle. Eleven of the species occur in the United States and bear various names according to their locality and the markings on the skin. Three classes are distinguished: (a) those with a chain of large, dark diamond-shaped patches with pale borders (e.g., Diamond-back Rattle-snake of South-eastern United States); (b) those with a row of rounded, dark-bordered patches (e.g., the Prairie Rattle-snake); and (c) those with a number of dark transverse bands (e.g. the Banded, or Timber Rattle-snake, *C. horridus*). Of all these creatures *Crotalus horridus* is perhaps the best known. It also has a wide range, especially over the Eastern States, and has

seven varieties. The colour is very variable and may be yellowish with wide, dark brown or black bands, or the ground colour may be black, brown or olive. The black varieties present a beautiful velvety appearance. The length varies between $3\frac{1}{2}$ and 6 ft. It is to be found commonly in the cane-brakes of the Eastern States, in the swamps of the Atlantic States, and in the mountainous districts of southern New York and Pennsylvania. Generally the snake hibernates in rocky cliffs, remaining till the spring, when breeding takes place. Rattlers are viviparous and from six to twelve are brought forth at a time. Not long afterwards the young leave the parent and go off on their own account, gliding like the parents to their summer hunting grounds. The temper and habits of the creatures vary with the localities, but the species is not the worst tempered of the group. The food consists of small warm-blooded creatures such as rabbits, mice, rats, small birds, and squirrels. It can be retained quite well in captivity and often becomes quite good tempered and even safe to handle, though this latter practice is never to be recommended. In the wild state Rattlers frequently occupy the holes of prairie-dogs and ground-squirrels, but they do not, as is often said, live amicably with them. They have few enemies excepting man and pigs, the latter eating them with complete safety.

Crotalus horridus, as we have said, is the common rattle-snake of the United States. *C. durissus*, which often grows to 8 ft. long, occurs in the South-Eastern States, and *C. confluentus* is the Western species.

Since these snakes are so common a word of advice on Rattle-snake poison may not be out of place. The symptoms are a rapid swelling and discolouring of the wound, followed in about fifteen minutes by staggering, cold sweats, prostration, vomiting, pulse irregularities and mental derangement to a slight degree. Death often occurs in about twelve hours in this state. Later the local troubles come into play and great swelling and discoloration may ensue with rise of temperature and respiratory trouble. This also may cause death. The vicious course is not even then completed and the sore may become gangrenous and death follow that. It is therefore much the wisest plan to refrain from trouble with the reptiles. Should one be bitten, however, the quickest and wisest thing is to ligature (tie tightly with string or rubber band) the limb a little nearer the body than the bite. Then cut well into the wound and let it bleed freely, aiding the process—*only if the mouth be free from cuts or bad teeth*—by sucking. Every effort should be made to keep one's self-control and medical help should be sought or sent for. The instructions under Snake Poison on p. 103 should be learnt and a few simple

remedies carried on a trip likely to be dangerous. The idea that whisky is a remedy in itself is quite unfounded.

The "Pigmy" Rattle-snakes belong to the genus *Sistrurus*. They are small (length up to 3 ft.) and possess rattles, but have the upper surface of the head covered with nine large shields. They also have a distribution over most of the United States and are poisonous, though to a less degree than their larger relatives. Ditmars wisely rejects the common name of "Ground Rattle-snakes" for this genus. All rattle-snakes are ground rattle-snakes, so his term "pigmy" is much more satisfactory.

In the character of the head scales this genus comes close to *Agkistrodon*. The latter closely resembles many of the Water Snakes in the general form of the body. They can, however, be distinguished by the usual pit between the eyes and the nostril and the elliptical, cat-like pupil of the Crotaline eye. The genus includes the very poisonous creatures known as Moccasins and Copperheads. Several species of the genus occur in the Old World, but three are common enough in the United States and Mexico.

The Water Moccasin is *Agkistrodon piscivorus*, a large and stout creature, olive-brown above with paler sides on which are dark patches. The young, which are born alive, are often brightly coloured. These snakes are found most commonly along the

Atlantic seaboard of the Gulf of Mexico. There they abound in the swampy ground and marshes, especially near pools which are drying and so penning and disclosing fish. They hang on branches or lie under logs, and when startled make off by diving in the water and hiding in the reeds. If cornered they will strike viciously, opening their mouth wide and revealing the white parts of the mouth, which has therefore caused them to be known as the Cottonmouth Snakes. In captivity they thrive well and are very docile, more so than any rattle-snake will ever be. They feed on rabbits, rats, birds, fish and other reptiles, but do not eat apparently their own kind. The bite is very dangerous.

The Copperhead is *Agkistrodon mokasen*. It is not so large or stout as the Moccasin, and is of a brown colour with rich brown markings. Beneath the colour is pinkish white, and the head often has the coppery colour which has given the snake its name. It inhabits rocky places, leafy glades and swampy districts and feeds on small mammals and birds. Its poison is said to be even more deadly than that of the Moccasin. Usually it will endeavour to escape, and as, when angry, it swishes its tail at a great speed in the leaves, it is easy to avoid.

The swamp habitat of the Copperhead has been vividly portrayed by Bret Harte in his fine lines on the snake :—

There is peace in the swamp where the copperhead sleeps,
Where the waters are stagnant, the white vapour creeps,
Where the musk of magnolia hangs thick in the air,
And the lilies' phylacteries broaden in prayer.

There is peace in the swamp, though the quiet is death,
Though the mist is miasma, the upas-trees breath,
Though no echo awakes at the cooing of doves—
There is peace: yes, the peace that the copperhead loves!

Like the others of this group it does well in captivity.

The "Fer-de-Lance" or lance-head is *Lachesis lanceolatus*, which is found in South America, Mexico and the West Indies. It is commonly known as the curse of the sugar plantations, as it is so common and so deadly. It has no rattle and can establish itself almost everywhere. The Mongoose was introduced to combat it, but the mammal has left the reptile very much alone. As it grows to 6 ft. long it is not a pleasant companion.

These deadly poisonous snakes are the pests of the regions in which they occur. They should never be unnecessarily provoked or handled, but none the less it should be remembered that they rid the world of many rats and mice, and that generally they will escape from man if possible. They are consequently not quite so harmful or so great a danger as reports often indicate. Fear of the harmful should not lead to slaughter of the harmless: the latter are often very important and helpful to the farmer.

Poisonous Front-fanged Snakes.

If we return to the third great group of the Colubridæ we find a group of snakes with front fangs grooved or hollowed for poisoning (see p. 54).

The American snakes of this type belong to the genus *Elaps*, and are known as Coral Snakes. Although related to the Cobras, they are rather different. Usually they have burrowing habits and seldom do they grow longer than 3 ft. From an anatomical point of view they are interesting as they lack one plate—the loreal—on each side of the head. The snakes are slender and have the head but little differentiated from the neck. Their colours are bright with coral red bands *completely* round the body. This helps, with the different arrangement of colours, to differentiate them from many of the harmless Milk and King Snakes which, as we saw, mimic them. Only two species occur in the United States and these are restricted to the Mexican border States. The snake burrows, often in old trees, and cannot live in captivity unless the opportunity to burrow remains. It lives on lizards and other snakes and has a very deadly bite. It lays eggs. Although generally sluggish it bites with suddenness and ferocity and is specially fierce when feeding. Although it is commonly stated that the Coral Snakes are too small to be dangerous to man, the author's advice is in this case, as in others, "to let well alone."

CANADIAN SNAKES.

Although the preceding pages have dealt with North America as meaning the United States and Mexico, the snakes of Canada should not be forgotten. They are quite similar to the northern United States kinds and include Garter Snakes, Water Snakes, Green Snakes, and King Snakes among the harmless forms. Rattle-snakes, of course, occur.

Enough has been said above to indicate the useful and the harmful snakes, their habits and behaviour in captivity. It is hoped that sufficient has been said to impress upon the reader that much pleasure and profit may be obtained from the study of snakes, both in the wild and in captivity. Care must always be taken, but nothing is more to be deplored—with snakes as all other creatures—than wanton slaughter.

SNAKE POISON.

The subject of snake poisons and their antidotes is one which, if omitted, would leave any work on snakes quite incomplete, for in the poisoning of man by snakes we come up against a serious problem in many countries, unimportant though it may seem in England. It is estimated that about thirty thousand people die in India every year from snake-bite; and Australia, South America and Africa can

produce figures equally disconcerting. There are of course many reasons for this large number. Both snakes and human beings are not indifferent in the tropics to shady places and pleasant by-paths. The natives seldom have any footgear, so that to stand on a snake is to be bitten, and very often to be bitten is to die, and die a death particularly unpleasant. Very few, if any, natives carry any preventive or apply any real anti-venom methods. How indifferent the natives are to some poisonous snakes is seen in the fact that even those who are employed in the snake farms often do not wear any foot covering and step quite boldly among the snakes. Fortunately, particularly in Brazil and India, active measures are being taken to combat this plague, as in some provinces of Brazil, where deaths used to be hundreds per annum, the number has been greatly reduced. The method of obtaining an antidote is by collecting venom from snakes kept on snake farms, or serpentaries as they are called, and inoculating horses in increasing doses. Eventually the horse-blood is run off and the remaining fluid bottled and sent out to the serum stations. For each snake a particular serum is required, but any serum will help the victim, as it is bound to eliminate some of the toxic characters. The virulence and nature of snake poison appear to be intimately connected with the type of prey and to vary accordingly even in

the same species. Roughly speaking, the effect of the poison may be put in two classes: a nervous effect and a hæmorrhagic effect. The poison itself is a thick yellowish fluid which in many cases can safely be swallowed, as the digestive juices dissolve it.

In Cobra poisoning, the bite is followed immediately by severe local pain. The patient becomes prostrated and has violent sickness and nausea, and a strong desire to sleep. The pulse becomes rapid and later slows down, while the patient becomes speechless and paralysed, dying from respiratory paralysis in half an hour or more.

In poisoning by Russell's Viper, there is considerable local swelling and blood destruction resulting in serious anæmia causing death.

The Krait, on the other hand, causes none of these symptoms, death being a slow process and the victim more or less subconscious all the time.

Of course a great deal depends on the condition of the snake and the strength and amount of its venom and the position of the bite, and also on the physical condition of the person bitten. If bitten, the victim should cut the wound open and suck out (if the mouth be free from abrasions) as much poison as possible. This should be done after ligatures have been applied above the wound, thus isolating the poisoned area. Two ligatures should be applied, one about 2 in. above the

wound and another much nearer the body. It is wise to carry crystals of potassium permanganate and a strong solution (as much as will dissolve in a teaspoonful of water) should be partly injected into the wound and at the side of it. A crystal of the chemical put into the wound will help if a solution is not available. Ammonia or strong spirits may be given the patient. The limb will certainly suffer if the ligatures are kept fixed too long, and consequently they should be loosened and refixed *one at a time* occasionally. Should the wound be on a part of the body, such as the head, where it is impossible to apply ligatures, the bitten part of the flesh should be cut out and the caustic solution applied to the wound. Where definitely dangerous snakes bite a toe or a finger in circumstances where proper attention is impossible, it is well to amputate the affected part. Caustic soda, carbolic acid, or a red-hot iron or burning gunpowder can be used if potassium permanganate is not available. People in snake-infested districts should always carry permanganate crystals. After first aid has been applied the patient should receive treatment and, if necessary, anti-venom serum at the nearest medical station.

Outfits consisting of potassium permanganate crystals and a small lancet are easily obtained from outfitters or druggists who serve the needs of travellers. The permanganate

does counteract the effect of the bite but it is not an unmixed blessing. It should always be applied *direct* to the wound and injection of a solution into a vein is dangerous. It is necessary to take great care of the wound after the chemical has been used, as a serious bite requires the permanganate to be applied in concentrated form, and concentrated permanganate has a destructive effect on tissues, so that scar formation often takes place on the wound. Following a bite, therefore, the wound should not be dosed with the chemical and left indefinitely, but care should be exercised for a considerable period afterwards, so that not only is the poison eliminated but the wound is kept free from the complications likely to affect diseased tissue in tropical or subtropical climates. Almost any first-aid box will provide the means for this.

The only definite method of neutralizing the poisons of snake-bite and avoiding the action of the toxins introduced by it is the serum treatment already referred to. Although possibly any serum for snake poison will eliminate some of the toxic effects and thus aid the patient, only a serum adapted for the particular species of snake causing the wound will give complete security. For this reason certain stations have prepared specific serums for the dangerous snakes of the district. For example, the Rockefeller Institute of New York has serums for Rattle-snakes and the Moccasin; the Pasteur

Institute of India for the Cobra and Russell's Viper, and the Butantan Institute in São Paulo has a number for the common poisonous snakes of Brazil.

The amount of poison injected into a wound is variable, dependent not only on the condition of the snake but on the size of the bite and its position on the victim, and on the species of the snake, because snakes vary much in the amount of poison produced.

It is best, naturally, to give the serum as soon as possible after the accident, and in a dose corresponding to the estimated amount of poison injected into the wound. The method of giving the serum is important. An ordinary injection under the skin or into a muscle may be sufficient for slight cases, but where any serious effects are to be expected the injection should be intravenous, that is, made directly into the appropriate vein. The quantity of the serum will vary with the gravity of the case, but Amaral¹ gives the minimum as 20 c.c. After the lapse of some time after the first injection, a second injection may be given if the poison symptoms show any reappearance.

Now that so many serums are available and the snakes of most parts of the world are well known it is an easy matter for the traveller who will run any risk of being bitten to provide himself with the necessary outfit.

¹ Amaral. "A general consideration of snake poisoning and observations on Neotropical Pit-Vipers." Harvard Institute for Tropical Biology and Medicine, 1925.

